# Editorial

THINGS are moving fairly rapidly in the television world, and all over the world according to reports from overseas.

The American FCC proposals concerning bracket standards have carried the color controversy a little nearer a conclusion but do not necessarily imply color television in the immediate future. It may, in fact, project color services still further ahead.

The decision has opened the deadlock which has existed in that country for some time, but I am quite sure it has not closed the subject of color television. Nor do I imagine that anyone in the USA feels that the bracket standards will be the final answer. Experience may show it to be the best and simplest for some little time, but I think we can watch what happens in the color world, safe in the knowledge that some really fast work will be accomplished.

In Australia, recent parliamentary debate extracted from the Government a pretty clear statement of its attitude to television. In brief, the policy is that present conditions do not warrant spending large sums of money on a complete television network, but do not prohibit at least one station being built as a pilot model. "Experimental" isn't really the right word, because the station will, in fact, be one of the most modern anywhere, and will be used more for experience than for experiment.

It is hard to quarrel with the reluctance of the Government to spend on television at the present time. I often wonder just how many realise what a torrent of labor and finance will be set in motion when the time comes for a full-scale television set-up.

Frankly I don't think the industry as a whole is jubilant over the need to spend money on television. It is, of course, most anxious not to miss out on it, realising the inevitability of video transmissions. But it is I think a little afraid of just where it will all end, and just how to go about making the most of a market without sinking too much too soon or too late.

One thing seems fairly certain, however, and that is that the Government is not likely to expand its television programme until many other problems involving finance are solved. The 25 per cent sales tax hasn't helped, for it adds another £25 to every £100 television set, and points pretty clearly to the classification of radio as a luxury.

John Moyle

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RADIO AND HOBBIES IN AUSTRALIA

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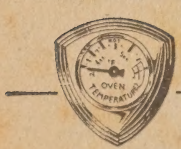
## OUR COVER PICTURE

This fine model of the RAF latest twin jet fighter epitomises the speed and grace of modern aircraft. It was the highlight of a recent RAF exhibition.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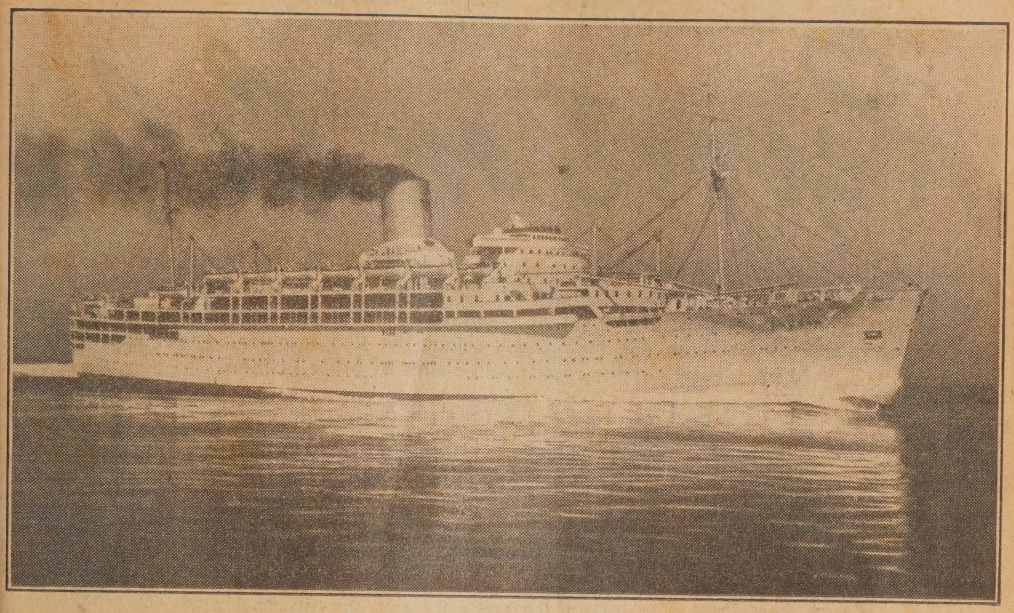
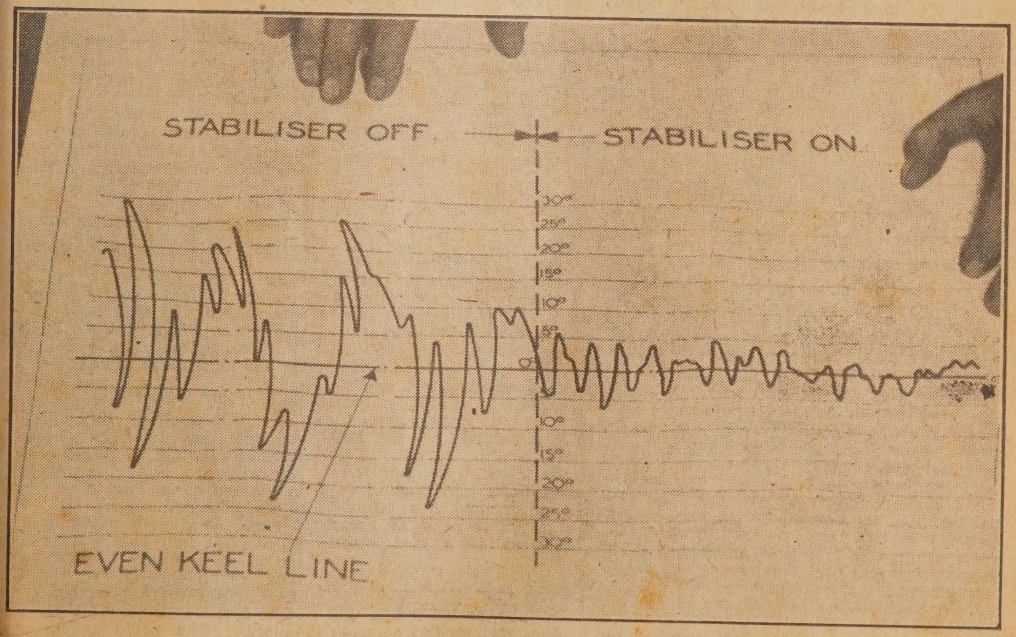





The use of an ingenious stabilising device makes "roll" and sea sickness almost impossible with the 24,000-ton luxury liner RMS Chusan, shown above. The graph in the lower picture illustrates how effectively the stabilising fins iron out the roll, and keep the liner on an even keel. See story on page 11.

# The Radio Scene

# Report on Color

**In an effort to reach some finality in the matter of color television, the American F.C C. has made a statement to U.S. radio manufacturers. In essence, it says that they must henceforth supply receivers adaptable to a new set of standards. Unless the trade adopts this guard against obsolescence forthwith, the F.C.C. will select the C.B.S. color system as standard, irrespective of the results and claims of other systems.**

THE main points exercising the mind of the F.C.C. right now are obsolescence and compatability—the ability of ordinary receivers to produce a monochrome version of possible color programmes.

The F.C.C. has been trying to reach a decision on this, one way or another, for months, but technical developments have followed in such quick succession that no finality has been reached.

Meanwhile thousands of television receivers are being made every week, and sufficient of them were in the hands of the US public to allow several million viewers to see the Louis-Charles fight.

Even now, before any system of color can be made available, tens of thousands more receivers will have been built and sold. And the F.C.C knows that new set owners will be up in arms if they are denied the right to see at least a black and white version of the eventual color programmes.

## SEPARATE RECEIVERS

They won't be happy either if they have to instal two separate receivers, one for color, the other for monochrome, each receiving a completely different group of stations.

The question is asked: "If color television is still in its infancy—and that is certainly the case—why go into it at all at this stage? Why not wait and see, as England is doing? And, last but not least, is color television really wanted?"

The proponents of this last question point to the cinema for an example. It has been possible, for years at increased cost, to produce any number of first quality color features but, in actual fact, they have not ousted the general run of black and white films.

Against this it is contended that the cases are not similar. Experts point out that, even allowing for mediocre efforts, a lot of editing and planning goes into the production of a film and, generally speaking, the dramatic interest is sustained. If it isn't, out come the scissors!

With television, a good deal of the programme material comes from sporting and outdoor events, and there may well be lengthy periods when nothing much is happening. During such periods, interest will lag immediately unless color is there to portray the grass, the sky, the colorful costumes, and all the other details necessary to build atmosphere.

## URGENT PROBLEM

Although the F.C.C. is probably subjected to a good deal of commercial pressure, it apparently believes in the "pro" arguments sufficiently to regard color television as an urgent problem, requiring immediate solution.

Unfortunately, there is far more to it than merely saying "yes, we will have color." The whole problem of introducing color is more complicated, if that is possible, than the original one of introducing television itself. You have first to evolve a whole new set of transmission standards, add to them additional standards for the color build-up, and then solve the vexed problem of compatability for good measure.

The earliest color work dates back to the 1930 era, to experiments by Baird in England and by the Bell Telephone Labs., in the US. This work demonstrated that color television was feasible and gradual development since then has brought it to the stage where it is about to be launched as a commercial reality.

## THE GUINEA PIG

It appears that the US public will be the "guinea pig" on this occasion, leaving other countries to profit from their experience.

It seems pretty certain now that in Australia, the PMG will be qui happy for a while to watch US effor to wrestle with the problem.

Although there are many variant color television work in the US h centred most around three riv groups which have pursued differe lines of approach technically, ea achieving a degree of success. Th methods employed are quite diffe ent, and the F.C.C. has to make u its mind which one is the best.

The Columbia Broadcasting Sy tem (C.B.S.) started out with th premise that you had to have a ne set of standards anyway, to g good color. It would only complica matters by trying to make the tran missions conform to the present bla and white standards.

Furthermore, when the exper ments were put under way, the was little offering in the way electronic color devices and the sy tem had to be essentially a mechan cal one.

Having reached these decisio Columbia provided their video came with a simple motor-driven col wheel. The wheel carried red, gre and blue filters and its speed w so arranged that each separate filt was in front of the optical system ju long enough for the camera to sc the complete scene, once.

## COLUMBIA SYSTEM

By this method they produc complete red, green and blue pi tures in sequence, or rather comple sets of video signals correspondi to the red, green and blue versio of the televised scene.

These were duly transmitted a received in the usual way and th fed to an ordinary "white" pictu tube, which was viewed through color wheel rotating at exactly t same speed as the one at the tran mitter. The rapid succession color images were seen by the view as a complete tri-color picture.

In essence, this system remin

one of the Baird rotating disc method which was abandoned many years ago.

On the surface, the C.B.S. system suffered from certain basic limitations, not the least of which was the necessity for using high speed color wheels in front of the viewing tube. If the tube was to be of a useful size, the color wheel would need to be of cartwheel dimensions.

Furthermore, all the problems of maintenance, noise, safety, synchronisation and bulk would operate against the C.B.S. system. And these very things had already spelt the doom of mechanical black and white television.

However, C.B.S. introduced many refinements, and they were also quick to point out that their system could change over to purely electronic reproduction when this has reached what they consider to be a satisfactory standard.

Quite apart from the method of reproduction, the C.B.S. field sequential scanning system calls for a high picture repetition rate, if flicker is to be avoided.

For black and white reproduction, it is sufficient to fill in the outlines of the scene at a rate of from 50 to 60 frames per second. However, if this same number of frames is to be subdivided between three distinct color images, the repetition rate for each color is limited to 20 or less, which can give rise to severe color flicker.

## STROBING

A further effect is that strobing occurs with moving objects. Under bad conditions, the object is split up into colored stripes or patches.

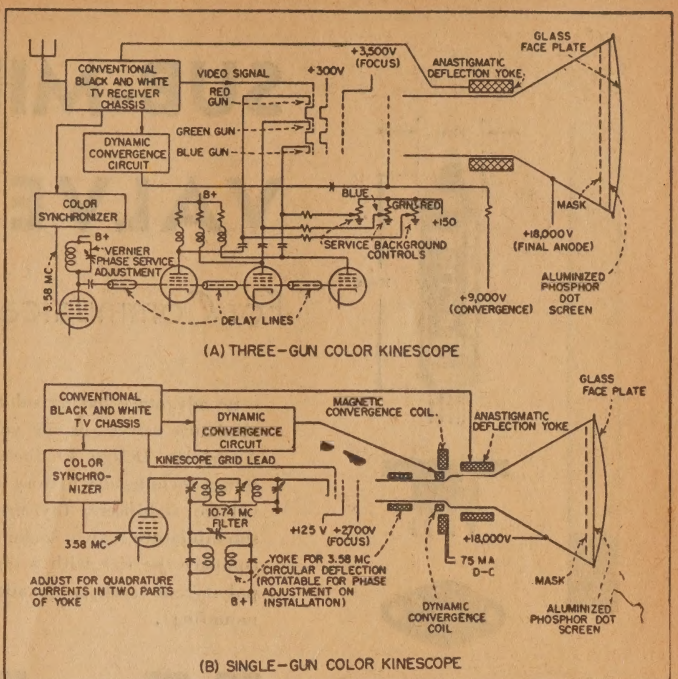
To overcome these effects, C.B.S found it necessary to raise the frame repetition rate, and, with it, the total band-width occupied by the transmission. As a result, the early C.B.S. experiments pre-supposed that much higher carrier frequencies would have to be set aside, and that the picture signal band-width would be about 16 Mc!

In an effort to avoid this exorbitant demand on "ether space," C.B.S. engineers cut down the number of picture lines, thereby slipping well below the resolution that was theoretically possible from the 525 monochrome standard. Many changes have been made over the period of experiment and it has now been found possible to compress the signal into a channel approximately 6 Mc. wide, which is similar to that required by a black and white station

But the point is that, out of all this, C.B.S. engineers have been able to turn on demonstrations, and offer arguments, which have made a favorable impression on the F.C.C.

The one big objection to the C.B.S. system from a commercial viewpoint is that the color transmission standards have nothing in common with the monochrome standards already operating, and therefore with those built into the nation's receivers.

Any station which might be permitted to commence transmission on these standards would have to face the problem of producing costly programmes in the hope that people would begin buying receivers to look at them.




This diagram from "Electronics" shows the essential details of the RCA color system using two types of tubes but the same general principle.

## ELECTRONIC APPROACH

Adopting the alternative approach, the two other concerns,, CTI and RCA, assumed at the outset that mechanical color scanning systems were doomed, and their efforts were directed primarily to producing an all-electronic system.

They further reasoned that the system should, if humanly possible, be compatible with existing black and white standards, so that the industry would not be faced with change-over problems. Individual stations could switch over to color, as they desired, and their viewers could continue to receive a black and white version of the picture.

It was entirely up to the viewer whether or not he purchased a new color receiver. If he did, the old set could be sold or traded in, because the new one would receive equally well in color or in black and white.

In taking up this stand, the engineers sentenced themselves to an enormous programme of original research, and progress was necessarily slow. However, the promise of all-electronic and compatible television was sufficiently good to make the FCC defer any possible decision in favor of the CBS system.

CTI dodged the problem of frame flicker by evolving a system of line sequential scanning. In other words, their camera produced a chain of video signals equivalent to alternate lines of red, green and blue. These are built up at the receiver into a complete picture made up from an ever-changing pattern of colored scanning lines.

Unfortunately, the line structure in any one color is necessarily rather coarse, and, under certain optical conditions, a line strobing or line "crawling" effect is produced, similar to that which results from a bad interlace. The rapid pattern of lines, each slightly displaced from the other, can give the effect of horizontal lines crawling across the picture.

CTI's method of color generation at the camera also sets a limit on the definition, but this is not beyond solution. Though the complexity of equipment at the originating station must be considered, it is secondary to design considerations for millions of individual receivers.

## FILTERS

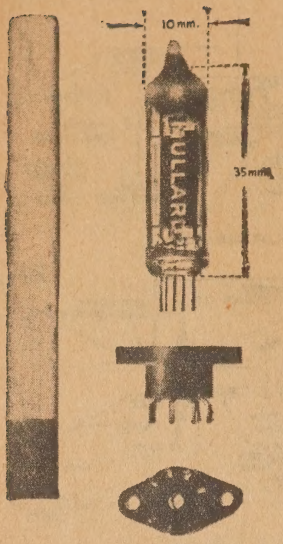
RCA carried the scanning procedure to its logical limit with the dot-sequential system.

The scene to be televised is broken up into its color elements by a "dichroic" mirror system and fed to separate camera tubes. These generate continuous video signals representing the primary colors, which are fed to an electronic sampler (or switch).

Operating at an extremely high rate, this sampler extracts from each channel in turn instantaneous pulses, whose amplitude corresponds to the intensity of the particular color at

# SUB-MINIATURE VALVES

## For Communications and Industry




—no advantage having sub-miniature components without sub-miniature valves—or vice versa—*both* are now available for the Australian Design Engineer and the Mullard Sub-miniature Range includes dry battery and 6.3 volt mains type VHF valves, voltage stabilisers, thyratrons and electrometer valves, and sub-miniature valve sockets. Diameter 10 mm. ($\frac{3}{8}$ inch)—compare the size with a cigarette—also the tiny silica loaded polystyrene sockets (available for both chassis and panel mounting).

*Data on a few of the Mullard sub-miniature valves is listed below. Further details available on application.*

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**TYPICAL CHARACTERISTICS**

| Type | Description | Length (mm) | Filament or Heater (V) | (mA) | Va (V) | Vg2 (V) | Vg1 (V) | Ia (mA) | gm (ma/V) | ra (KΩ) | Pout (W) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DF72 | Sharp cut-off R.F. Pentode | 41.2 | 1.25 | 25 | 67.5 | 67.5 | 0 | 1.7 | 1.0 | 650 | — |
| DF73 | Variable-mu R.F. Pentode | 41.2 | 1.25 | 25 | 67.5 | 67.5 | 0 | 1.7 | 0.8 | 450 | — |
| DAF70 | Single Diode A.F. Pentode | 41.2 | 1.25 | 25 | 67.5 | 67.5 | 0 | 0.9 | 0.45 | 200 | — |
| DL75 | A.F. Output Pentode | 41.2 | 1.25 | 25 | 90 | 90 | −3 | 1.3 | 0.67 | 500 | 0.047 |
| EF70 | High Slope R.F. Pentode with Short g3 base | 38 | 6.3 | 200 | 100 | 100 | −2 | 3.0 | 2.3 | 100 | — |
| EF72 | High Slope R.F. Pentode | 38 | 6.3 | 150 | 100 | 100 | −1.4 | 7.0 | 5.0 | 200 | — |
| EF73 | High Slope non-R.F. Pentode | 38 | 6.3 | 200 | 100 | 100 | −2.0 | 7.5 | 5.0 | 250 | — |
| EC70 | R.F. Triode for use as Oscillator up to 500 Mc/s | 38 | 6.3 | 150 | 100 | — | −2.0 | 13 | 5.5 | 3.6 | 0.75 500 Mc/s |
| *EA76 | Single Diode | 25.4 | 6.3 | 150 | 150 (r.m.s.) | — | — | 9 (max) | — | — | — |
| 70B1 | Voltage Stabiliser | 50.7 | V burning = 70V., Current range = 5-15mA., A.C. resistance = 300Ω. | | | | | | | | |

* 5 mm diameter bulb. Leads disposed on pitch circle of 2.3 mm diameter.

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the instant of sampling. In other words, the pulses correspond to a succession of red, green and blue dots right along each line.

The individual pulse trains are then fed to low-pass filters, which tend to round them out into a sinoidal wave form having the fundamental pulse frequency and a peak amplitude controlled by the pulse amplitude. These wave trains are passed out to the transmitter and thence to the receiver.

Here the sampling process is reversed and the local sampler, operating in step with the transmitter, extracts from the carrier envelope pulses which closely approximate the original pulse and color values. The picture is thus built up again from an enormous number of color dots, which shift their position each frame to give an overlap effect.

## FINER DETAIL

But what of the high frequency components which were removed from the video signals by the low-pass filters? These higher frequencies, representing the fine detail of the picture are combined to form what is virtually a monochrome detail pattern and fed to the transmitter in the normal way as the outer sidebands.

At the receiving end, these outer sidebands are used to impose a monochrome detail pattern over the color pattern. The ultimate result is somewhat similar to a printing process which imposes black lines and shading over the three basic color inks.

For the system, R.C.A. has coined the term "mixed high" transmission.

All this is very involved, in terms of color receiver design. However, a black and white receiver is largely unaware of the machinations with dots and sidebands. It accepts the video carrier on its face value and proceeds to reproduce an ordinary black and white picture. Hence the compatability.

It appeared, not so long ago that R.C.A. had the game pretty well "taped" but apparently their progress or the final result is not in line with F.C.C. expectations. They are obviously not prepared to sit by and watch experiments much longer while the American public continues to buy standard receivers.

## BRACKET STANDARDS

In an attempt to buy time, the F.C.C. has now circularised manufacturers and asked whether they are prepared to release new television receivers incorporating what they have called "bracket" standards. In the main, these new receivers would have a switch which would change the line frequency from 15,750 to 29,160 per second and the field frequency from 60 to 144 per second. The latter figures in each case being in line with the standards proposed by C.B.S.

This would mean that, for the time being, such receivers would be used with the switch set for the present standards. Indeed, should the F.C.C. system, the alternative provision would never be required.

However, if the decision went in favor of the C.B.S. frame sequential system, the switch would simply be flipped over the other way and the receiver would operate immediately to produce a monochrome version of the C.B.S. color picture. A single adaptor would then serve to provide for color reception.

By this proposal, the F.C.C. obviously hopes that at least some purchasers will be saved the experience of having their sets become partially obsolete overnight. They probably hope, too, to build up an immediate and potential monochrome audience for possible C.B.S. color transmissions.

Unless the industry indicates its willingness to fall in with this plan —and the deadline has already expired—the F.C.C. has said that it will immediately terminate the period of initial research and give the green light to Columbia and its standards. This would mean that television manufacturers could, if they wished, go ahead with new combination receivers based on the frame sequential system.

## ELECTRONIC PICTURES

Apparently R.C.A. and other companies are not overmuch concerned by this development, since production of receivers to the "bracket" standards will give them the extra time required for further research.

Whichever way it goes, R.C.A. and the other big tube manufacturers will have their hands full, because it is almost certain that electronic television will win out, irrespective of the standards involved.

Up to date, to produce an electronic color picture, it has been necessary to use three separate picture tubes, their output being combined and viewed via a di-chromatic mirror system. There are obvious difficulties in keeping the three images in perfect register since, in addition to ordinary optical difficulties, the scanning currents must maintain the three pictures to exactly the same proportions at all times.

The optical difficulties were removed by producing a tube having a screen made from countless pyramidic structures, each face covered with a phosphor giving a characteristic red, green or blue glow. Cathode-ray beams from three separate guns, impinging on these distinct faces, built up the complete picture. Problems of electrical registration and trapezium distortion still remained, however.

RCA licked these by producing its three-gun tube, as recently mentioned in these columns. Three gun-structures are mounted side by side to produce three separate beams, simultaneously focused and deflected by coils over the neck of the tube.

## PICTURE SCREENS

The beams impinge, from slightly different angles on a plate just behind the fluorescent screen and covered with a complex pattern of fine holes. The fluorescent screen is made up from countless triangular patterns of colored phosphor, so arranged that each color dot is affected by the beam which approaches it from a particular angle through the screen.

The beams, separately modulated, go on their merry way, each exciting its own color dots to a greater or lesser degree and thereby building up the complete color picture.

A refinement of this uses a single beam which is rotated magnetically at a high speed, so that it appears to come from three different directions at the precise intervals in time, thus doing the work of the three separate beams.

## MASKING PLATE

The job of piercing a masking plate with tens of thousands of precisely positioned holes and then placing behind them a maze of triangular phosphor dot patterns is one which staggers the imagination. And this has to be done, not for the half dozen experimental tubes produced to date, but for the millions of picture tubes which will ultimately be required, and that at a moderate purchase price!

Be that as it may, the tube manufacturers are apparently quite happy to go ahead on that basis and produce the three color picture tubes the industry will need.

And it will need a lot of other tubes beside, for the addition of color in any form calls for more circuits, more adjustments, more tubes and more things to go wrong.

We hope this more or less technical recital has not proved wearisome, but to appreciate the color position, it is really necessary to have some idea, however general, of the main technical points involved.

One thing is fairly obvious from the FCC decision. It is impossible yet to clarify the path to eventual color. The industry has, in fact, been told to try again. But in case CBS should win, at least those sets made under "bracket" standards won't have to be thrown out. If RCA should win, then all sets including bracket sets, can be used. For this reason, it is possible that the FCC secretly hopes RCA will win, but hasn't overmuch confidence that it can do so, at least on its present lines.

## AUSTRALIAN PLANS

How does all this affect our Australian plans? At the moment, not at all. We won't be faced with the necessity for such a decision until we are ready to manufacture sets and transmitters for a permanent service. Nor will the outcome one way or the other affect the wisdom of erecting a couple of experimental stations to "get the feel" of television and carry out vital field research.

It underlines once again the need for this experimental approach, and the disastrous results which could follow the acceptance of any standards offering at present as a basis for a permanent system.

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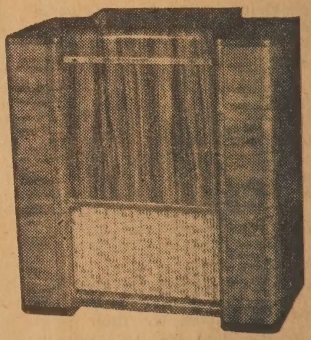

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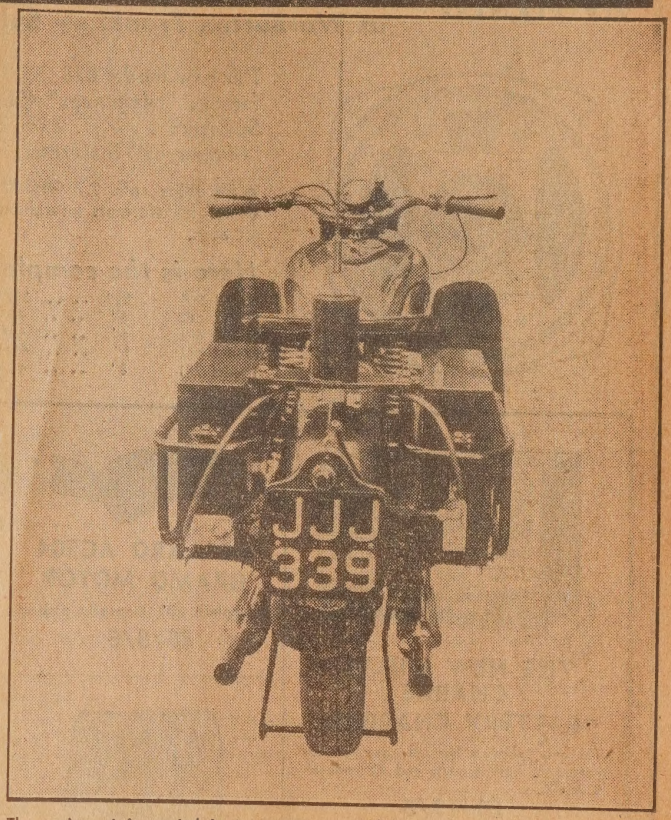
A SELECTIVE calling system is available whereby one, or all, of ninety units, each consisting of one or more vehicles, may be called from the control station. This system can be supplied either to "lock-out" all stations not being called, or to allow these stations to interrupt communication between the fixed and a mobile station should it be necessary. Notification of an incoming call is given by a bell or buzzer and a lamp.

Installation is neat and unobtrusive, the receiver with selective calling, transmitter and power unti being combined within two waterproof cases mounted on either side of the rear wheel. Every effort has been made both to distribute the weight evenly and to keep the centre of gravity low.

## POWER LOW

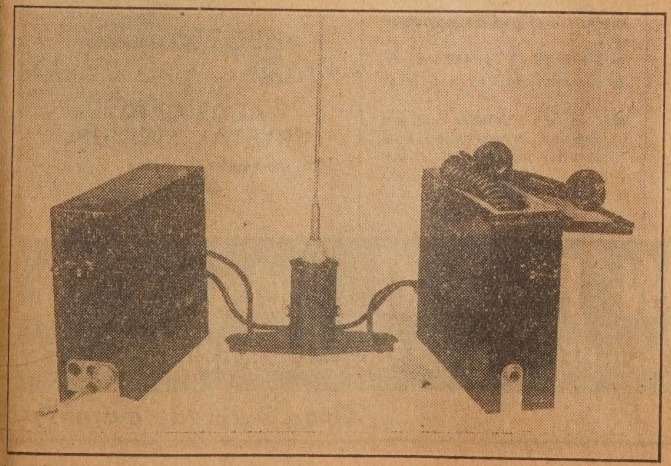
Power consumption on "standby" is claimed to be as low as 18 watts, service being about 20 miles, dependent on terrain and installation conditions, when operating in conjunction with a 20-watt control transmitter.

This 27 valve equipment is crystal controlled throughout, and therefore requires no adjustment in operation. Sensitivity is 1 microvolt carrier input for 10 dB quieting. Spurious responses are at least 60 dB down on wanted signal. Fully tropicalised in accordance with RCS 1000, all components are suitable for use within the temperature range -40°C to plus 71°C with humidity as stated for K110.




The equipment is carried in two cases mounted one on each side of the cycle. The aerial unit is carried on the luggage rack.

It is stated that use of a low multiplication factor obtainable with the recently developed Plessey modulation technique virtually eliminates the radiation of spurious frequencies from the transmitter. Frequency deviation is plus/minus 15 Kc/s.



Here are the units which make up the complete motor cycle equipment.

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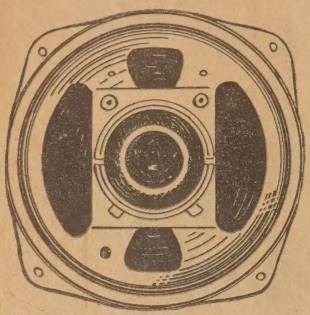
What does the earth look like from Mars? Actually, clouds and haze in our atmosphere constantly obscure most of the earth's surface. Some color would appear from time to time; and our polar ice gleams brighter than other areas when the sun strikes it. proportionately, the earth's surface is smoother than that of a pingpong ball, although we have peaks, such as Mt. Everest, measuring up to 11½ miles high .

# A *NEW* MODEL "MAGNAVOX" SPEAKER IS HERE

***It has recently joined the big "Magnavox" range at Warburton Franki — Sole Victorian Distributors.***



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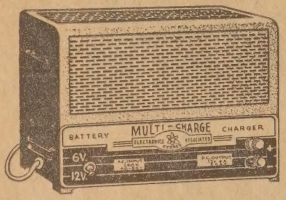


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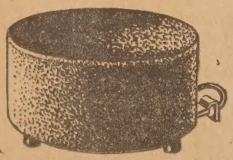

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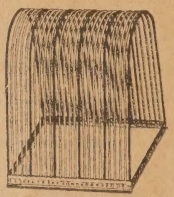

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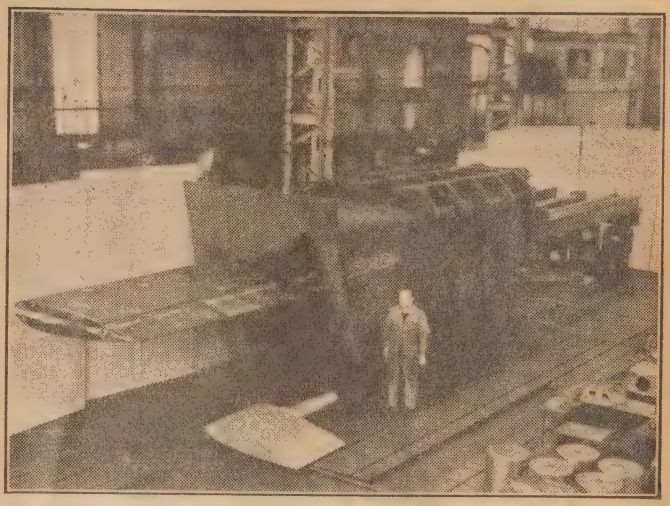
# THIS LINER JUST CANNOT ROLL

THE rolling of a ship which takes place as the ocean swell sweeps under the hull means that one side is lifted as the water level rises, only to be depressed a little later during the passage under the hull of the trough between each "wave."

If some method could be devised which prevented this rise and fall of the ship, it obviously would not rock. Treatment of the ship itself seems indicated because so far no one has thought of a method by which waves can be ironed out flat in the immediate vicinity of the ship.

Most people are familiar with the method by which an aircraft is made to bank either way when the ailerons on the wings are raised and lowered. By providing a pair of "underwater wings" with a variable angle of incidence, this angle being automatically adjusted according to the amount of roll to be corrected, a Scottish firm has succeeded in keeping a ship on an even keel.



This picture shows the stabiliser fin for the port side of the Chusan before installation.

**The stability of ships at sea has always been a major problem to designers and ship-owners alike, as the millions of sufferers from sea sickness are able to testify. This new device promises to eliminate roll even under severe conditions, as demonstrated by the trials described here.**

## DENNY-BROWN SYSTEM

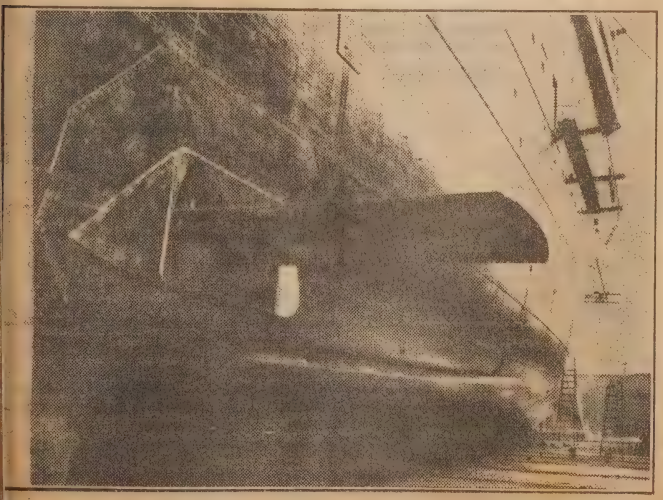
While steaming at 19 knots off the Isle of Wight, the new 24-000-ton P. & O. liner RMS Chusan was forcibly made to heel over many degrees to port and starboard. She was then brought back to an even keel by the "Denny-Brown" system of stabilising fins, fitted for the first time to a luxury passenger liner.

The intention was to demonstrate the working of the "Denny-Brown" stabiliser by the manipulation of fins on each side. The stabiliser has been adopted successfully for cross-Channel ships and has been fitted in many destroyers of the Royal Navy. It was perfected during the war and installed in over 100 naval craft, none of which, however, exceeded 3600 tons.

The stabiliser consists of two fins fitted at bilge level which are retractable when not in use. The principle on which it operates is that two rectangular fins lie approximately horizontal in the same horizontal plane, each fin mounted on a shaft so arranged that it is hydrodynamically balanced. In operation, the fins tilt about the gyro position and are controlled so that their angular movement is equal and opposite.

The forward movement of the ship causes an upward force of water on one fin and a downward force on the other, thus combining to reduce any roll produced by wave action. The control is automatic and is operated by two small gyroscopes, one measuring the angle of the roll and the other its velocity.

On trials carried out, Chusan was made to roll—by reversing the stabilisers—and left the vertical by 17 degrees on either side, yet this roll was killed in six seconds. Complete success of the stabiliser opens up new possibilities of stability for ocean-going liners in the roughest seas and gives new hope to world travellers who suffer from seasickness.



The starboard fin, which measures 12ft in length and more than 6ft in width. Fins are retractable.

---

HIGH frequency radio warning equipment patented recently can give the engineer of a speeding train a continuous indication of whether another train is on the track ahead, and how far away it is.

The equipment is designed to supplement the usual safety system on US railroads.

# It's New... It's News!..

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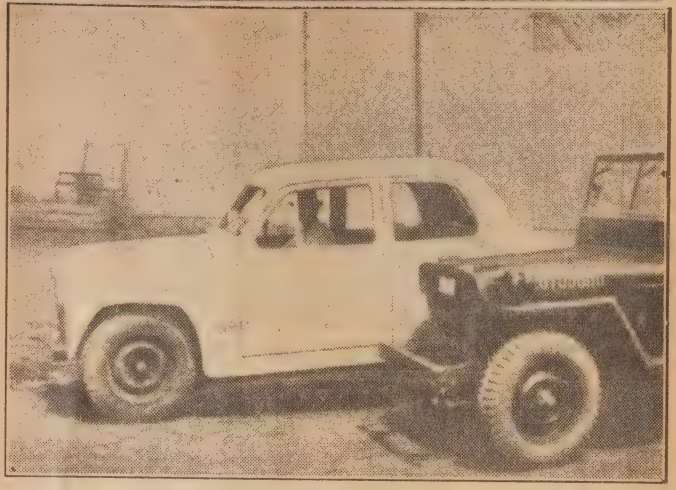
# BATTERIES DRIVE JAPAN'S JEEP



The Tama Senior is shown here alongside an American jeep demonstrating that it is actually smaller in size. A second model is even smaller.

**It is not so long ago since a strange motor car was seen regularly in the streets of Sydney, if indeed it is not still in use. Its progress was smooth, silent, and stately. The reason—it was driven by an array of batteries, and filled up from a mains plug each night instead of at a petrol pump.**

THE battery idea probably had a number of disadvantages which prevented it from making much headway against petrol driven cars. But in Japan, at least, it appears to be making a comeback in one of those fantastic ways, which are so crazy that only the Japanese, who doesn't know it can't be done, makes it work.

The cars are built by the Tokio Electric Automobile Company, according to reports, and will run 125 miles without a battery charge. As it would be bad practice to flatten batteries anyhow, between charges, it's pretty certain that when the car is finally parked for the night, the owner plugs the charger into the appropriate socket, and tops them up during the night.

The car comes in two models. Whether it is the Japs' love of small things, or whether it costs too much to make big cars, at any rate the larger of the two Tamas is about the same size as the jeep, or a little smaller. As the illustration shows, however, it is a sedan job, and would probably look pretty smart bowling along at a top speed of 33 miles per hour.

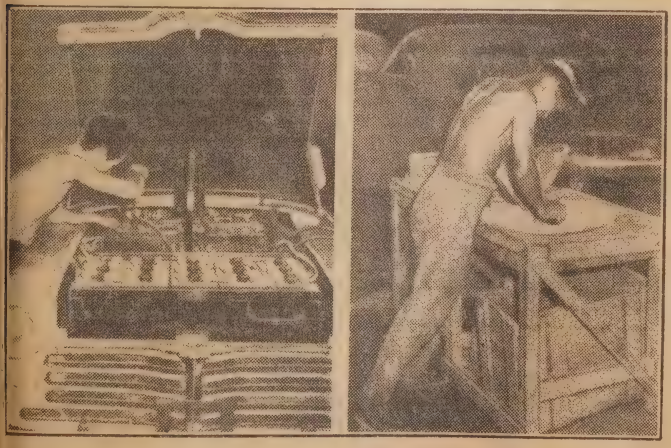
There are, however, still more amazing things about this car. It is entirely hand-made. The body is made of wood as a framework, after the style of the 1920's, after which the metal body panels are hand-fitted. There is no heavy machinery — each car is actually "custom built." This is made possible, because in Japan, labor is still obtainable at a cheap rate.

Once the body is assembled, it is mounted on a wooden dolly, and rolled round from department to department, until the final assembly is complete. The worker, who makes each part, also installs it. The factory makes everything except the wheels and the electric motor. The upholstery is also done by another firm.

Painting is done by hand, and the pigment for the paint is actually ground at the factory.

The greatest flexibility is possible in this manufacturing method, for there is little difficulty about making modifications or changing a model Everyone just agrees to hammer out a part in a different way, or to fit a panel with a different curve, and there you are! Tooling up is a thing of the past, or is it the future?

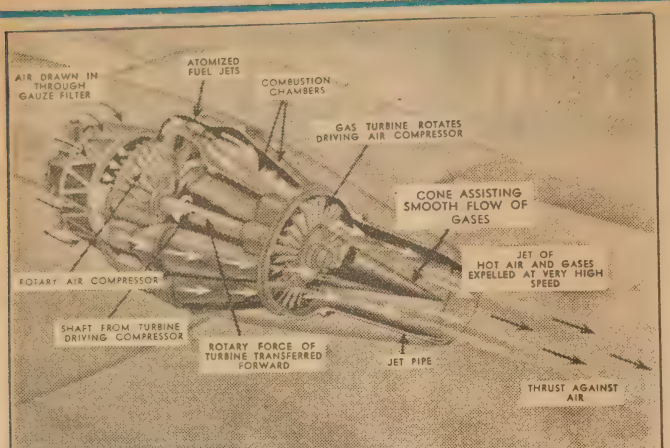
Naturally, the factory hasn't a huge output — about 30-40 cars per month. And the price isn't really low —about £800 for the larger model. It makes one wonder, however, just what the price would be if a modern factory got to work on a similar car. In the meantime, the patient Jap turns it out by hand.



The batteries which drive the car are shown in the picture at the left, housed under the bonnet. At the right is seen the grinding of pigment to make the paint.

## ELECTRONIC FERTILITY DETECTOR TESTS EGGS

ELECTRONICS may soon tell poultry-farmers which eggs are fertile, thus eliminating the present trial-and-error method of incubation. All that is needed, according to Karl Norris, of the US Department of Agriculture, is an instrument to measure minute differences in response to electric current. Fertile eggs respond differently from non-fertile eggs. Modern electronics may soon produce a practical device for measuring the few millionths-volt difference that shows fertility, Norris says.




The jet engine, big news in today's aviation, depends on a simple principle which is not always understood.

# WHY DO THINGS HAPPEN?

**Despite the complexity of man's machines they depend in the main on quite elementary rules of physics. This article discusses simple examples which illustrate the operation of these rules.**

ONE of the reasons why science is unpalatable to many people is the difficulty which they find in understanding the language in which many of the scientific laws are framed. To attempt to imagine, or form a mental picture of, the results of a law is difficult. Thus the job is given up, and what could be a most interesting subject is lost to an otherwise earnest investigator.

All of us remember the way in which, at school, we mechanically carried out the physical experiments as laid out in the text-books.

Unless one had a "flair" for the subject, our experiments were considered somewhat in the same light as a meal consisting wholly of spinach garnished with castor oil.

## MIXTURES AND SMELLS

The most interesting matters were, of course, those which led to something concrete, such as mixing up some sort of explosive with which to frighten the life out of the teacher or an unsuspecting schoolmate.

Our chemical experiments became matters of great interest when we found out how to make the most abominable smells with iron sulphide and hydrochloric acid. These things had prospects.

Then, of course, we found that we could, with a little phenolpthalien mixed with water, cause this colorless liquid to turn red—then colorless again by adding equally colorless solutions of soda or vinegar, as the case may be. This was magic, and possibly gave the answer to many of the tricks performed on the stage by the great conjurers. Beyond this many of us considered chemistry and physics as subjects to avoid.

In this age of science, however, there are many who now wish they had taken a little more interest in the subjects. The newspapers, day after day, reveal more and more amazing scientfic excursions, and we now feel that a little knowledge of the laws of science would enable us to understand the whys and wherefores of the matter.

## SIMPLE EXPERIMENTS

Fortunately, there are some simple experiments which any enthusiast can perform which will demonstrate the principles involved and sometimes help to remove some misunderstandings.

For our first example we will select Newton's third law of motion. What could sound more uninteresting than the bald statement that "to every action there is an opposite and equal reaction"?

Yet here is the law upon which the science of jet propulsion is based.

by Calvin Walters

Have you ever jumped out of a rowing-boat on to the shore? You have probably noticed that, when you jump, the boat sails off in the opposite direction. Indeed, most people who have rowed boats have had the alarming experience of having one foot on the shore and one in the boat and being left in a precarious and incongruous position, doing the "splits," with deep wet water beneath.

This is an example of Newton's law. In order to jump forward you also pushed backward with the same force.

## REACTION

Another example is the recoil of a gun or the unrecommended method of forcing tomato sauce out of a bottle by bashing the end of the bottle.

In order to witness the force of reaction, you can obtain a bottle two-thirds full of acidulated water. This can be done by putting some vinegar with the water—about a ounce of vinegar will do.

Put the bottle on a pair of household scales, drop into it a small quantity of alkali, such as baking soda, wrapped up in absorbent paper and cork the bottle.

As the soda contacts the vinegar carbon dioxide gas will form and gradually fill the space in the bottle. Watch closely until the pressure of gas shoots the cork from the bottle. When this happens, the scale will be depressed by the reaction on the bottle.

Some people have the idea that a jet plane or rocket is propelled by the force of the jet pressing on the air. This is a common fallacy.

If this were so, rockets could not be propelled past the earth's atmosphere, where there is no air to push against.

## REACTION MOTOR

What happens is that, obeying the law of reaction, the hot gases emanating from the nozzles at the rear tremendous force must also propel forward on the front of the machine, thus propelling it forward. There is nothing new about jet propulsion. Hero of Alexandria, who flourished about 100 to 150 years BC, thought up the idea and made a novel engine which he called an aeolipile.

This gadget took the form of a hollow ball, from which tubes, bent backwards, protrude at opposite diameters. The whole affair was pivoted at the centre and when water

was heated in the ball the steam coming from the tubes caused the assembly to revolve. Today the counterpart of this device exists in the revolving garden lawn sprinkler.

A simple jet engine can be made by taking a talcum powder tin which has one of those screw-on tops. Tighten the lid and punch a small hole in the bottom near the edge. Put some water in the tin first. Bend up some wire and wind it round the tin so as to make four legs. Stand this boiler in a light aluminium soap dish floating in the bath. Put a piece of lighted candle under the boiler and when the water boils and steam issues from the hole in the tin the "boat" will sail along in the opposite direction to the steam.

## THE SWERVING BALL

Steam cannot issue from the hole unless it presses on the front end of the tin. Opposite and equal reaction. By the way, don't have the water boiling too fiercely and see that dad supervises the experiment, so that the tin won't blow up. Just have the boat going long enough to see what's happening. If you want to make a better outfit you will have to fit a safety valve.

Over 200 years ago a smart fellow named Daniel Bernoulli discovered forces which are responsible for quite a few well-known effects, such as the curved flight of a tennis, golf, or ping pong ball which has been "sliced." The action of a paint spray, garden spray, and all such devices, also depends upon these forces, but most important perhaps is the fact that the aeroplane gets its lift because of these self-same forces.

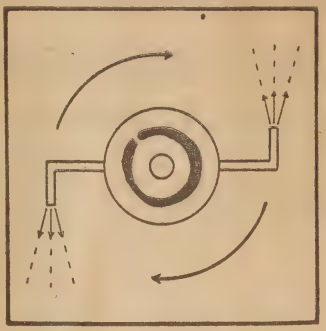
The clever Bernoulli formulated a law which is rather difficult to understand when read as written in the text-books. It says, in effect, that when the velocity of a fluid (air is included in this) is increased, the pressure inside the fluid is decreased.

## QUESTION OF PRESSURE

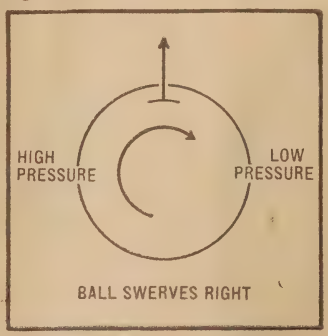
There doesn't appear very much in this at first sight. It is hard to believe that the pressure on the inside of a hurricane is less than that outside.

There are two kinds of pressure to consider. First, there is "dynamic" pressure and secondly static pressure. The first is the pressure developed when the fluid collides with something and the second is the pressure of one particle against another inside the fluid. It can be demonstrated that dynamic pressure rises with increase of velocity and static pressure falls in proportion.

If you suspend two balls, about 1½ inches apart, by fairly long cords and blow between them you would expect the balls to fly apart, but they don't. They come together. You create a region of low pressure between the balls by blowing through the gap and the normal air pressure on the outer sides of the balls pushes them together.



The common garden sprinkler shown simplified above operates on the jet principle.



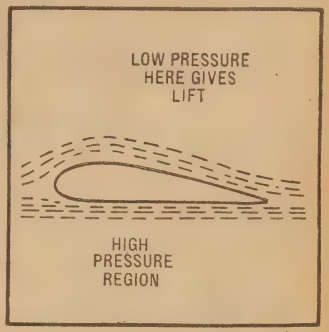

This diagram illustrates the "swerve" of a tennis ball.

The same thing is responsible for the action of a toy balloon when placed in a strong current of air.

Fix up your vacuum cleaner so that it blows instead of sucks.

You can do this by connecting it up as if you were intending to use the sprayer attachment. Turn the vacuum cleaner on and place a toy balloon in the draught of air.

The balloon will stay suspended in mid-air. Why? Because every time it tries to get out the high pressure outside the air stream pushes it back into this higher speed low pressure air. Of course, the air stream will have to be directed upwards at an angle, otherwise the force of gravity will overcome the velocity of the draught of air and pull the balloon down.




It is the low pressure above the aircraft wing which causes it to lift.

When a tennis ball is "chopped" or a golf ball is "sliced," it is given a spinning motion. This spin carries the air around with it so that on one side of the ball this air is moving in the same direction as the current of air caused by the forward rush of the ball. On the other side the air carried round with the ball is moving against this forward air current. The result of all this is that on one side of the ball the total air velocity is faster than on the other side and the ball curves toward the side which has the fastest moving air flowing past it.

In the case of the familiar spray the draught of air being forced across the upper end of a narrow tube produces a region of low pressure across the tube. As this is lower than the pressure of air inside the container and therefore at the lower end of the tube, the higher atmospheric pressure forces the fluid up the tube and it is caught in the draught of air at the top and carried along with it to the unsuspecting mosquitoes.

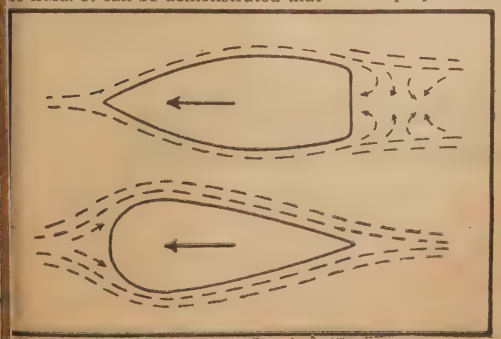
## TOP LIFT

These forces discovered by Bernoulli give most of the lift to an aeroplane. A lot of people think that it is the air flowing under the wing of an aeroplane which gives it the lift. This is quite wrong.

Most of the lift is caused by the air flowing over the TOP which causes this most desirable attribute. Want to prove it? Right. Take a piece of paper about two inches wide and, say, 10 inches long, and hold it between your thumb and forefinger, so that the paper hangs down in a curve over the back of your hand.

Have the palm of your hand facing toward you then blow across your thumb and along the top of the paper. What happens? Did you blow the

(Continued on Page 95)



For streamlining, the tapered point should be at the rear to avoid "drag".

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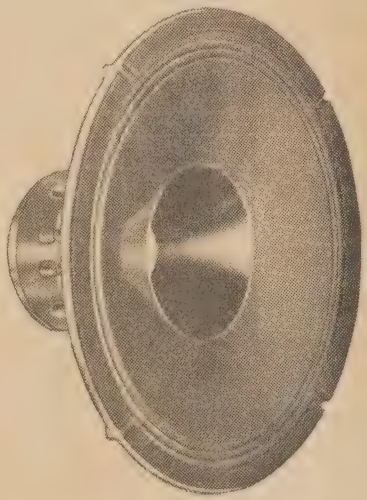

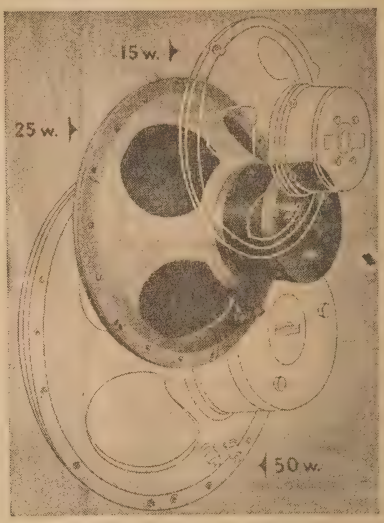


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# Technical Review

## OPTAR—A NEW SYSTEM OF OPTICAL RANGING

An ingenious combination of optical and electronic principles, which has earned the name "Optar," was described recently before the American IRE by H. E. Kallman. It has already produced a prototype electronic guide for the blind.

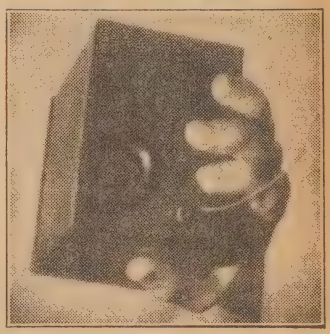


Figure 1. An external view of the device for guiding the blind.

TO understand the principle of optar, it is necessary to refer first to the basic optical illustration of figure 2. This depicts a convex lens which produces images whose size and distance from the lens is proportional to the size and distance of the original object. It is, in fact, possible to gauge the size and distance of the object by determining the size and position of the image behind the lens.

The method suggested for determining the image position involves placing a comb-like interrupting vane in the region of focus (see figure 3) and moving it so that it interrupts the light field. The interrupted light falls on a sensitive multiplier phototube, which tends to produce an a-c component, dependent on the interaction of the moving combs and the distribution of light over the field.

### OBJECT IMAGE

In a perfectly flat light field, there would be no change in light intensity and no modulation. However the introduction of an object into the field increases the tendency to produce output, the tendency being most marked when the position of the comb coincides with the image of the object in question.

Thus, by moving the comb longitudinally, the point of maximum output gives the image position and therefore the distance from the lens of the object. The measure is primarily one of distance and the dimensions of the object can be gauged by swinging the Optar device through the requisite arc.

For the precise measurement of distance, two combs can be used, slightly displaced from one another and arranged to give a complementary output. Two positions of maximum output are obtained with a null point between them, the null being the significant measurement.

The device for the blind has a disc mounted on a diminutive motor and so arranged that the edge of the disc lies in the optical field. Around the edge of the disc are marked a number of radial lines arranged in groups and made progressively finer so that they tend to produce about eight separate audio frequencies as the disc spins through the optical field.

The disc is also distorted in such a way that the different line groups spin through the field at progressively different distances from the lens. As a result of this, images at differing distances cause one or other of the frequencies to predominate in a small earphone.

It is claimed that a blind person could soon learn to gauge the distance and movement of objects from

(Continued on Page 51)

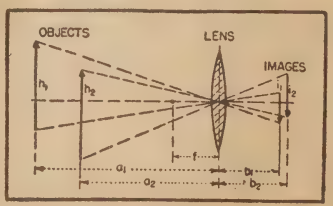



Figure 2. A familiar optical illustration. Optar locates an object by measuring the position of its image.

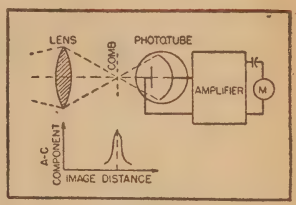



Figure 3. The fundamental Optar system showing how the a-c component peaks when the comb corresponds with the image position.

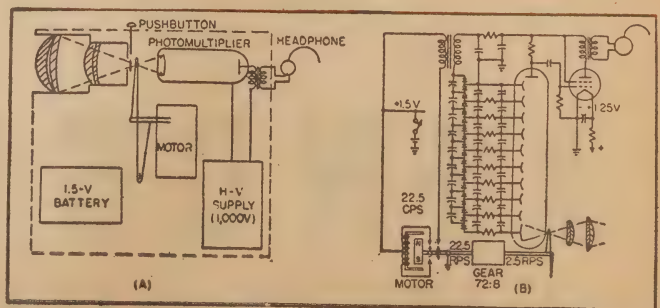



Figure 4. The mechanical arrangement of the blind-guide and, on the right the electrical circuit. All this operates from one torch cell.

# BUZZER BECOMES 10,000 m.c. GENERATOR

**Combination of an ordinary 800-cycle buzzer with a tunable cavity provided research workers with a microwave oscillator tunable over the range 3000 to 11,000 Mc. Output is as much as 200 microvolts across a 200-ohm load.**

ONE of the problems of work in this extreme region is that of obtaining convenient signal sources. Accurate single-frequency oscillators can be produced but these have serious limitations for testing receivers covering a wide range of frequencies.

A simple tube-less oscillator has helped solve this difficulty. The initial energy comes from a simple 800-cycle buzzer of the door-bell type which is used to excite an adjustable cavity resonator. The output is therefore modulated at 800 cycles, while the frequency stability is purely a function of the cavity construction.

## SCALING

To produce the original instrument, the usual scaling procedure was used in reverse in that a large scale, low frequency model was built up to discover the significance of problems which might be associated with tuning, coupling, output control, &c.

This large-scale prototype, measuring some 22in x 15in overall was made up by the local tinsmith and quickly earned the nickname of "ashcan." It operated in the region 120 to 440 Mc., where there was no shortage of suitable gear for taking performance measurements. Despite the use of ordinary galvanised steel, the "Q" of the cavity was found to be good.

Positions were found for the coupling loops and the nature of the oscillation studied over the "scaled up" band it was proposed to cover. Then engineers were able to establish that a closed cavity would be preferable and also to discover the positions slits intended to suppress spurious modes of oscillation.

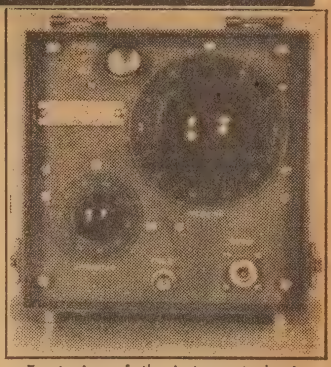
## CURRENT DRAIN

With such problems solved, the final microwave instrument was produced and its performance was found to correspond very closely with expectations. Current drain from the self-contained batteries is from 50 to 150 milliamps, giving at least 300 hours of operation, with no problems of heat-up time, maintenance, &c.

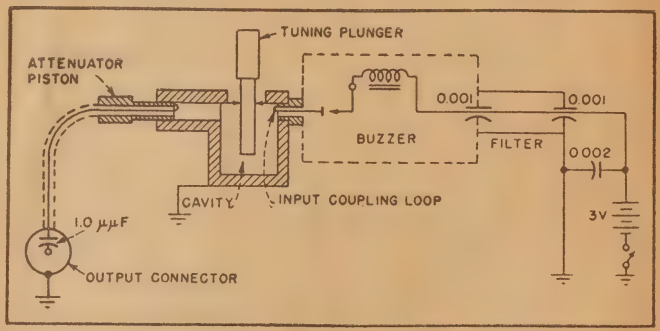
The simplicity of the scheme is evident from the schematic circuit. The buzzer, energised from a 3-volt battery produces sharp pulses of current, which are coupled into the cavity through the coupling loop. The cavity is sharply resonant at one particular frequency, as determined by the plunger position.

Harmonic components in the buzzer output excite the cavity at its resonant frequency, so that it produces constant oscillations which are picked up by the coupling loop and fed out through a piston-type attenuator.

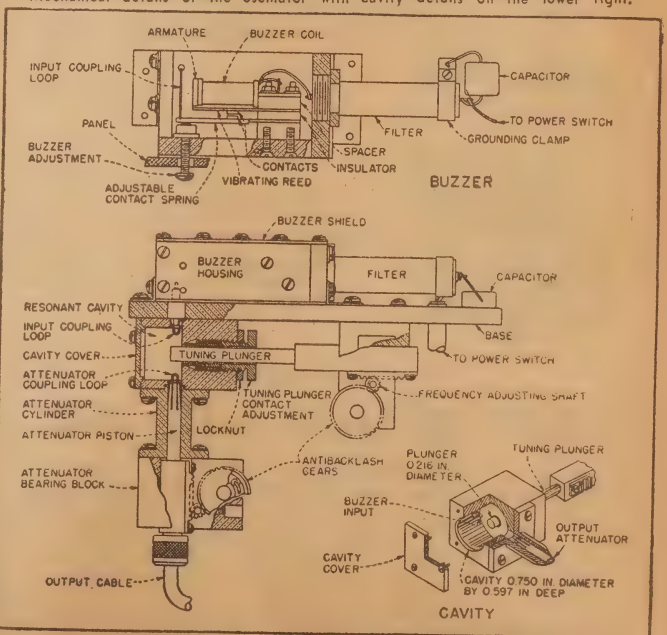
The buzzer produced pulses comprising a 5-amp breaking current through the contacts, with a 200 volt peak across the coil. It was necessary to select a type which gave a suitable operating frequency but with a clean make-and-break action. Some buzzers were found to exhibit "bounce" in the contacts, producing a virtual wave train rather than a single steep wave front.



Front view of the instrument showing the dial at the top right and the attenuator on the lower left of the panel.




Mechanical details of the oscillator with cavity details on the lower right.




An equivalent electrical circuit for the buzzer-oscillator.

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Fitted with large direct reading meter with illuminated dial and OVERLOAD PROTECTION. Tests over 2000 American English and Continental valves including latest types. Filament volts range from 1.1 volts to 117 volts. Filament continuity and element shorts shown directly on meter. Cathode leakage read in megohms. The instrument is housed in a solid oak carrying case and supplied with comprehensive instruction manual. Also available as valve tester minus multitester ranges—Model 45 A-S.

**MULTITESTER RANGES.** 1000 ohms per volt A.C.-D.C.

| D.C. Volts | D.C. Current | A.C. Volts | Resistance |
|---|---|---|---|
| 0-120 m.V. | 0-0.6 mA | 0-3 | 0.5-22.5-1000 ohms. |
| 0-3 | 0-6 mA | 0-15 | 50-2250-100,000 ohms. |
| 0-15 | 0-30 mA | 0-150 | x 500-22,500-1 megohm. |
| 0-150 | 0-150 mA | 0-300 | x 5000-225,000-10 Megohms. |
| 0-300 | 0-1.5 Amps | 0-600 | |
| 0-600 | | | x with external battery. |

**PRICE £39/17/6 Plus sales tax.**

IMMEDIATE DELIVERY

## MODEL 75A

RANGES 20,000 ohms per volt A.C.—D.C.

| D.C. Volts | A.C. Volts | A.C.-D.C. Current | Decibels | Resistance |
|---|---|---|---|---|
| 0—0.1 | 0—1 | 0—50 uA | —30 to —5 | 1—50—10,000 ohms |
| 0—2.5 | 0—2.5 | 0—5 mA | —22 to +3 | 1000—50,000—10 Megohms |
| 0—10 | 0—10 | 0—50 mA | —10 to +15 | *10,000—500,000—100 Megohms |
| 0—50 | 0—50 | 0—500 mA | +4 to +29 | |
| 0—250 | 0—250 | 0—5 Amps | +18 to +43 | *With external battery. |
| 0—1000 | 0—1000 | | +30 to +55 | |

**This is a robust 20,000 ohms per volt 50 range universal multimeter designed for accuracy and stability. Fitted into an attractive case, the meter is provided with instantaneous OVERLOAD PROTECTION. The clear, easy to read scale has a length of 4 inches. An internal buzzer is provided for quick continuity tests. Complete with test leads.**

**PRICE £19/15/- Plus sales tax.**

## MODEL 120A POCKET MULTIMETER

RANGES 1000 ohms per volt A.C.—D.C.

| D.C. Volts | D.C. mA | A.C. Volts | Resistance |
|---|---|---|---|
| 0—0.25 | 0—1 | 0—10 | 0.5—20—2000 ohms |
| 0—10 | 0—10 | 0—50 | 50—2000—200,000 ohms |
| 0—50 | 0—50 | 0—250 | *500—20,000—2 Megohms |
| 0—250 | 0—500 | 0—500 | *5000—200,000—20 Megohms |
| 0—500 | | 0—1000 | |
| 0—1000 | | 0—2500 | *With external battery. |
| 0—2500 | | | |

**This is an accurate pocket size instrument using a robust, sensitive meter movement fitted with instantaneous OVERLOAD PROTECTION and is housed in a high grade moulded case. All resistors used for voltage and current ranges are adjusted to an accuracy of 1%. Supplied complete with test leads.**

**PRICE £9/17/6 Plus sales tax.**
DIMENSIONS: 4¼" x 3¼" x 2"

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Taylor Best for TEST EQUIPMENT

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# RADIO IN THE AFRICAN JUNGLE

**With so much attention focused on television, it comes as a shock to realise that some countries are still grappling with the problems of introducing sound broadcasting to the population. A recent report from the Director of Information, Northern Rhodesia, outlines the problems of broadcasting in Central Africa.**

HIGHLIGHT of the report is the success of the Saucepan Special, a British-built "poor man's radio" designed especially for use in Central Africa. It's acceptance by the native population foreshadows a tremendous advance in their education and outlook.

The big problem of the Rhodesian Information Department, as revealed by the report, is to educate the Central African natives and also to keep them sufficiently well informed to protect them against native agitators. Without radio, the process looked like taking three or four generations, which was far too long a period.

## COMMUNITY SETS

On the other hand, broadcasting was plainly futile if the natives lacked receiving facilities and "community" receivers in the ordinary sense were deemed a failure.

The problem, therefore, was to introduce individual receivers to the native homes, remembering that the total monetary income to the majority of such homes barely averaged one pound per month. On the surface, it seemed unlikely that any receiver could be marketed which would be within the purchasing power of such folk.

However, a search was made throughout Britain and the Dominions for a possible source of supply and, ultimately, one large British manufacturer decided to investigate the matter and produced a few pilot prototypes retailing for £5 each.

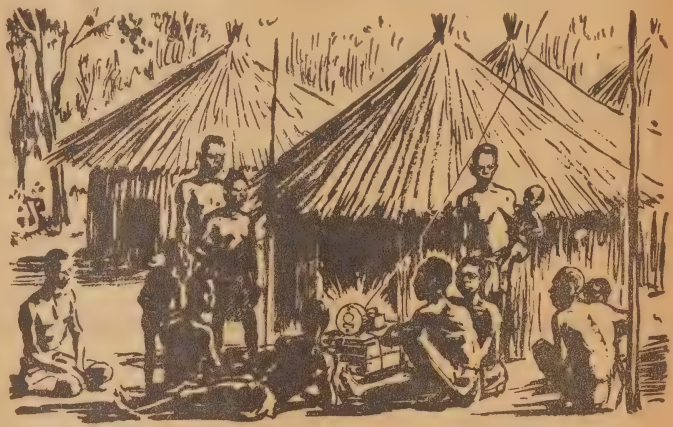
These were immediately sold to African buyers and a subsequent check showed that they were well received. Accordingly an initial order was placed for 500 more receivers for the African population, 1500 sets for official use and with sufficient future promise to warrant setting up a full production line.

In actual fact, the full initial consignment of 2000 sets was sold privately and there was an immediate and outstanding demand for further stocks.

## LOW PRICE

Many factors assisted in creating this demand. Low profit margins for the distributors allowed the receivers to be sold for £6/5/-, including batteries, while a transport company undertook to deliver them over all their motor lines free of cost. Government loans were arranged to assist public servants, while natives often "pooled" their salary to make the purchase. Many could afford to do this because the small communities are fairly self-sufficient in regard to dwellings and food.

The total population of Northern Rhodesia is a million and a half and, apart from those living in industrial centres, it is spread out in some 20,000 villages, each comprising a dozen or so family huts. Initial target is to see at least one family receiver in each village.



Our artist's impression—the "Saucepan Special" brings Radio Lusaka into an African village.

At the present time some 300 sets per month are being sold and, allowing for ten listeners to each set, the radio audience is growing at the rate of about 3000 listeners per month.

At the present time some 300 sets casting takes place on short-waves and the "Saucepan Special" is therefore a short-wave receiver only. It will tune the normal range of short-wave stations in addition to the popular local African station Radio Lusaka. Technically, the set is described in the report as follows:—

## THE RECEIVER

"The Saucepan Radio is a simple but efficient short-wave receiver operated by an external dry battery of 90v. HT and 1½v. LT which gives 300 hours' service.

"The cabinet of the receiver is, in effect, a large aluminium saucepan (without handle) of nine inches diameter with a back plate attached by screws and sealed, and a gauze-covered opening at the front of four inches diameter. Above this opening is the combined on-off switch and volume control and below it the two-speed tuning control and tuning dial. There is no tone control or other refinement.

"The set stands on black bakelite knobs, the tuning dial is white, the appearance of the receiver is more attractive than one would imagine. It is painted blue since research in the various colonies in Africa revealed the fact that one tribe or another had some kind of superstition about almost every other color. The back plate is tight fitting and the three holes in it are gauze-covered, so that the set is entirely insect proof. It is also tropically finished throughout.

"The receiver is a formal (though simplified) four-valve superhet type. Its range is from 25 to 90 metres. The aerial and earth wires are attached to the set, and it is important that the earth system should be used with this receiver. Before the sets are distributed a small copper plate is soldered on to the earth wire which should be buried about nine inches in the ground.

"The receiver and the battery, which is about 8 inches by 3 inches by 5½ inches, each weigh just over seven pounds.

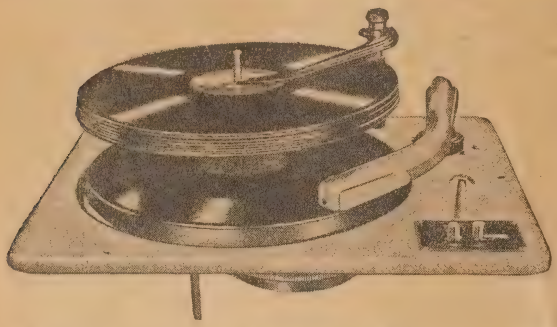
## SERVICE TROUBLES

"The aerial wire supplied could with advantage be lengthened."

Experience in handling the receivers has shown minor failings in the construction and packing ar-

**(Continued on Page 89.)**

# two of the best . . .



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*Check these outstanding COLLARO advantages against any other record-changer.*

1. With only three moving parts the COLLARO always remains in adjustment and cannot jam.
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## *The best on record . . .*

*Also available in straight and midget light-weight types.*


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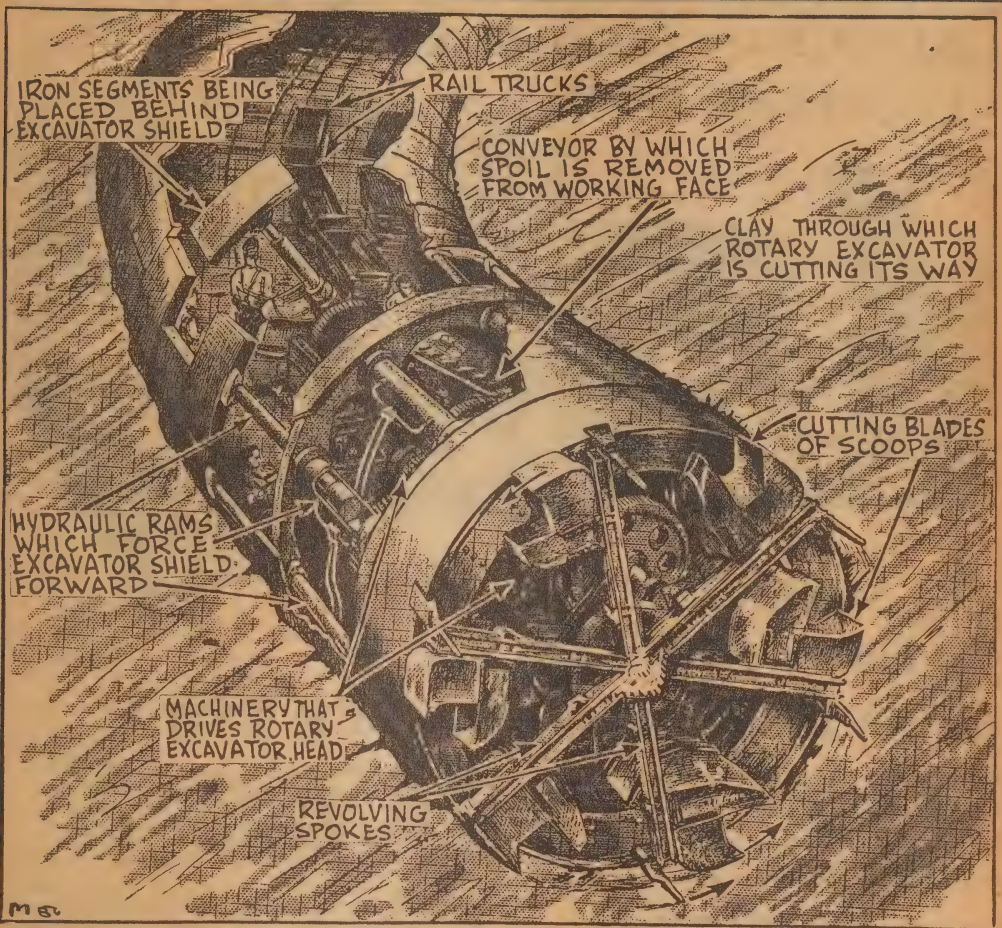
EI/2455

# HOW IT WORKS-ROTARY EXCAVATOR




Modern engineering methods have greatly simplified the problems of tunnel-making, and special devices and methods have been developed to deal with the construction problems met with. There are, broadly, three types of tunnels—those driven through hard rock, those driven through mixed soil and rock, and finally those through very soft rock or clay.

IT is a little over a century since the famous engineer Marc Isambard Brunel introduced a shield to expedite tunnel boring. The shield was constructed to the full diameter of the tunnel. It was kept pressed against the working "face" and, in the open compartments into which it was divided, men worked with pick and shovel.

By present standards, Brunel's shield was primitive, cumbersome, and not too safe. From it have been evolved wonderful tunnelling shields, however.

The remarkable rotary excavator, for use in tunnelling through clay, is illustrated here. This excavator bears some similarity to the snow plough as well as to Brunel's tunnelling shield. Rotary excavators such as this have been used to a considerable extent in tunnelling through London's clay.

Forced forward by powerful hydraulic rams, the electrically-driven rotary excavator head uses mechanical cutters to remove the spoil from the working face.

The spoil is thrown back and fed to the conveyor, which in turn carries it back to the railway trucks that operate within the finished section of the tunnel.

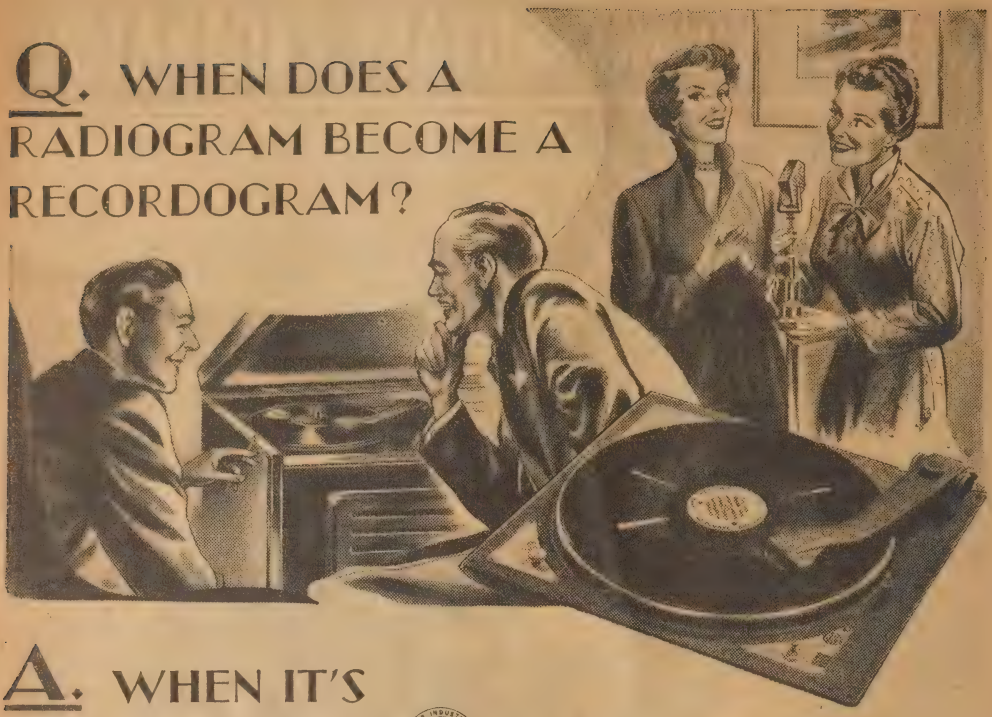
The hydraulic rams that force the excavator forward press against the iron segments of the tunnel already fixed in position behind them.

The direction of forward movement is controlled by regulating the force exerted by the individual rams. Thus the tunnel may be driven straight forward, or may be curved to left or right, or sloped upward or downward, according to the requirements of the prepared plans. For driving curves, pressure is exerted by the rams on one side only. For downward slopes, the pressure is exerted only by the rams on the upper segment, and for the upward slope by the rams on the lower segment.

Excavation of a tunnel may proceed simultaneously from both ends of the tunnel in order to speed up the work. When the workings meet, they do so exactly because of the accuracy of preliminary calculations.

With a rotary excavator of the type illustrated in this diagram-sketch, tunnelling progress at the rate of 25ft a day is possible.

# Q. WHEN DOES A RADIOGRAM BECOME A RECORDOGRAM?



# A. WHEN IT'S FITTED WITH A BRS R-12-D RECORDING AND PLAYBACK UNIT!

Convert you Radiogram easily and economically and have all the fun of making and playing your own records. The operation of the R—12—D is so simple a child could use it—a flick of a switch—a foolproof control adjustment and it's ready to record from either a microphone or radio. And the records you make . . . . well, you'll find they're right up to commercial standard for volume and fidelity and can be played back immediately. Recordings can be made at 2 speeds, 33⅓ or 78 r.p.m. and ordinary commercial records are reproduced with crystal clear quality. The R—12—D will provide you with a most fascinating hobby—one you can share, too. The R—12—D is available for either standard groove or microgroove.

## MICROGROOVE

### CUTS COSTS OF DISCS BY 75 PER CENT

Microgroove recordings, which are recorded and reproduced at 33 1-3 r.p.m., have four times the capacity of ordinary standard groove discs. This makes it possible to record 8 three-minute numbers or one complete short work on each Microgroove recording, resulting in a 75 per cent saving on discs.

Apart from longer playing time and saving in space and cost, Microgroove being cut at lower recording levels gives infinitely better reproduction. This is particularly noticeable in increased high frequencies with less distortion.

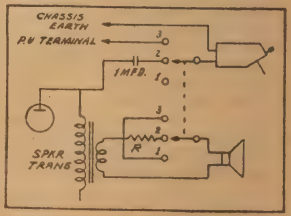
The extremely low noise level of BRS discs makes them ideally suited for Microgroove use, the noise being still far below that of standard pressings. MICROGROOVE is the last word in sound recording technique.

## SAPPHIRE STYLUS SHARPENING SERVICE

Byer Industries have now installed precision sapphire stylus sharpening equipment. You will save pounds by taking advantage of this quick expert service.

## EASY TO INSTAL

The installation of the R-12-D can be easily and cheaply effected. All you need are a few low-cost components and this simple circuit diagram.

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**BYER INDUSTRIES PTY. LTD.**

**8 Dorcas Street, Sth. Melbourne, Vic.**

# NEWS AND VIEWS OF THE MONTH

## Australia's Radio Stars

THE "radio stars" which have been the subject of so much successful experiment in Australia have again been in the news. Their existence was discussed as one of the features of the recent International Radio Science Congress in Zurich, Switzerland.

Leader of the Australian delegation, Dr. D. F. Martyn, who is chief of the Radio Research Board of the CSIRO in Canberra, said the Australian discovery was one of the most startling disclosures made at the congress.

Australian experts had received these strange signals on television wavelengths, he said.

"We can only presume that they are stars," said Dr. Martyn, "for although we know their exact location from he radio signals, they cannot be seen even with the strongest telescope.

"They are still much of a mystery, and just about all we know is that these radio-sending objects do exist."

Dr. Martyn added that other delegates confirmed this discovery, but it was found that Australian research into these "mystery radio stars" was by far the most advanced.

There is not the faintest suggestion that these radio signals are being sent by any living beings on the "radio stars."

## Air Tides

Another discovery made by Australia was that giant air tides in the upper atmosphere had profound effects on long-distance radio communication. Dr. Martyn said these tides were far more regular than sea tides.

Many of the delegates from more than 20 nations who attended the congress praised Australia's efforts so highly that it was decided to hold the next congress, in 1952, in Sydney and Canberra.

Proof of Australia's advance in these subjects is a recent mission to America by Dr. Martyn, Dr. R. Woolley, Commonwealth Astronomer, and Professor L. G. H. Huxley, of the Physics Department, Adelaide University, to advise the US Air Force on upper stratosphere problems.

## These Arguments

"LET'S Buy An Argument," by Neville Williams, has proved one of our most popular features. More and more readers have written in about their ideas, their agreements and their differences. It's a pity we can't print them all.

One or two, however, have been inclined to think his style a little too outspoken, and have been disturbed by his trenchant criticisms.

Let us say here and now that our editorial policy has always been, and always will be, completely impartial and objective. Neville's idea was to stimulate good-humored discussion with profit to all.

Radio and Hobbies has never printed an ill-natured word. Under no circumstances would it do so. Strong differences of opinion have been expressed from time to time with quite a number of people in the radio world, but never have they been worded or intended to cause offence.

Any reader of our magazine who has any doubt about Neville's intentions can be sure they are completely friendly. Those who interpret them otherwise can only have their own reasons for doing so, or perhaps are inclined to take themselves a little too seriously.

So far, Neville hasn't looked like wilting under the verbal pressure. We can't think our readers have any less endurance!

## Light Goes Faster

THE generally accepted figure for the speed of light has been wrong by 11 miles a second, according to the British National Physical Laboratory.

The announcement said that the laboratory's experiments had confirmed the British figure of 186,282 miles a second obtained in 1947.

This figure would displace the previous figure of 186,271 miles a second which the American scientist Albert Abraham Michelson established.

Recent experiments in America and Sweden agreed with the new British figure to within one kilometre (five-eighths of a mile) a second.

"The new British figure will enable more accurate use of radar and will establish new and finer basic calculations in atomic research, astronomy, and radio," the announcement added.

## Duty on Radio

THE radio trade was most unpleasantly surprised to find that one of the provisions for the new Federal Budget was the imposition of 25 per cent sales tax on radio sets and components.

It is fairly obvious that if extra taxes are required, they must come from somewhere. At the same time, the Government policy was announced as being in favor of taxing luxuries at the expense of essential commodities.

At any rate, "luxury" is about the only category into which radio sets can fall in the Government's list of items due for extra tax.

The tax is a very stiff one, although the present 8 1/3 per cent reduces the effective increase by this amount.

What seems rather hard to follow is the classification of radio as a luxury. Once upon a time one might have thought so, but today a home without a radio set is dull indeed. Not only because it is denied a wide font of entertainment, but it cannot keep in touch with what is going on. With news and opinion, descriptions of events, police messages, and even Parliamentary debates. It is a necessary contact with the community at large. There is nothing of a luxury about it.

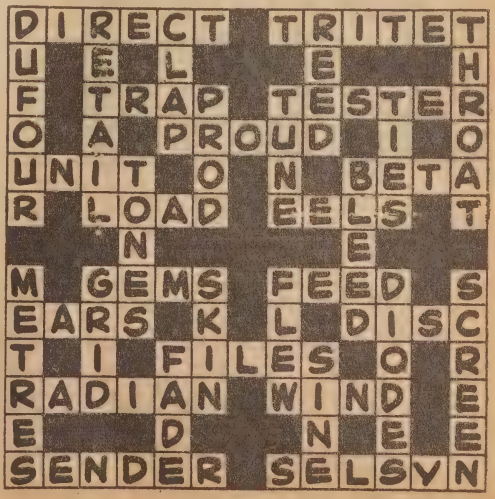
In this issue there is an interesting story of a Government attempt to bring radio sets to the natives of Northern Rhodesia. That story in-

## Last Month's Solution

☆

We regret to announce that our radio crosswords have been suspended for the time being.

☆



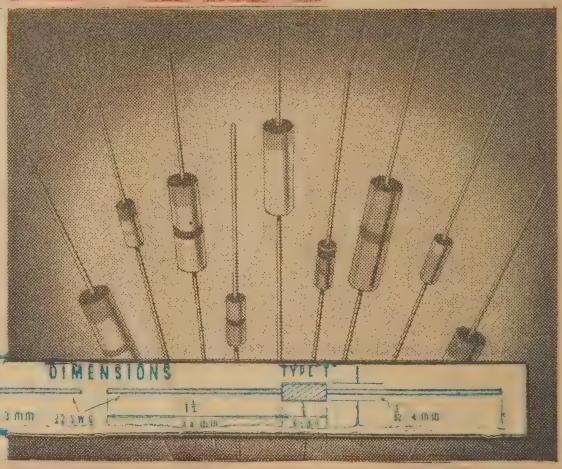
# MORGANITE RESISTORS

## TYPES T and R

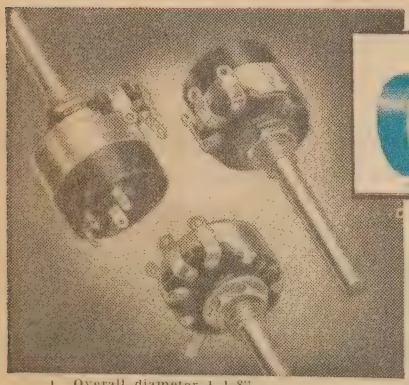
These moderately-priced BRITISH Resistors combine high performance with unusually small size. They are made accurately to their stated resistance values and are consistently stable.

The simple construction of Morganite Resistors provides small, robust, light weight components of high power dissipation and low operating temperatures, and are colour coded to RMA Standard.

Stocked in preferred Standard values, viz., 10—12—15—18— etc., values rising in 20 per cent steps (approx.). Morganite Resistors Preferred Value Ranges are standardised in U.S.A. and U.K., and are now available in Australia.




# MORGANITE MINIATURE POTENTIOMETERS



New in design .. British made .. and fully incorporates the traditional Morganite standard of quality.

Radio engineers will appreciate not only the small compact size of the Morganite Potentiometer, but the fact that it is available with a single or double pole switch of proved Morganite reliability.

## SPECIFICATIONS

1. Overall diameter 1 1-8".
2. Double pole or single pole switch operated from shaft.
3. Pressure diecast rotor and shaft for accuracy and strength.
4. DOUBLE CLENCH TERMINALS eliminate noisy joints.
5. Same track design for switch and non-switch type enables interchangeability. Switch type converted to non-switch by interchanging covers.
6. The renowned MORGANITE RESISTOR TRACK LOW noise, hard wearing, wide range of standard resistance values and gradings. Rating ½ watt.
7. Standard position fixed tapping available.
8. Double prong SPRING CONTACTS, in special non-tarnishing metal for resistor sweep, maintains correct pressure for minimum noise without wear.
9. The switch withstands the most rigorous operating conditions. Rating: 2 amps. 240 volts.
10. Instrument QUALITY at LOW Prices.

**THE MORGAN CRUCIBLE CO. (AUSTRALIA) PTY. LTD.**

BOURKE ROAD, ALEXANDRIA, N.S.W.

TELEPHONE. MU1371 • CABLES & TELEGRAMS "MORGANITE" SYDNEY

cludes the text of some native letters telling of their reactions to the radio sets, and appreciation of the Government which made them available at a low price.

Of course there are quite a few points in which we cannot draw parallels, but if it is radio and isn't considered a luxury for Rhodesian natives it can scarcely be considered so in Australia. Radio sets are dear enough in any case without loading them with a further mark-up.

The extra tax also applies to radio parts, and even to radio cabinets. So that even the home builders will be asked to dig deeper. Fortunately many home builders have a stock of odd parts many of which are quite suitable for use when rebuilding.

The man who will really feel that extra slug is the modest wage earner setting up a home in which we are quite certain he will forgo many things not generally considered luxurious before he can afford to be without a radio set.

Frankly, we could think of many more intelligent methods of making up tax income than slugging the radio industry.

★ ★ ★

## Fuelling At Speed

ONE of the most intriguing and spectacular things we've seen for some time was a recent newsreel shot of a British jet fighter refuelling in the air.

This isn't a new idea. Well before the war a flying boat used to fill up from an airborne bowser housed in a bomber of almost equal size. But these were comparatively slow craft —slow enough to hook a line one from the other, and haul in a fuel pipe.

Much neater was the fighter's technique of today. The tanker was a larger aircraft of course, and it trailed a hose ending in a cone-like nozzle with the wide end at the rear.

From one wing of the fighter protruded a pipe, looking for all the world like the barrel of a cannon.

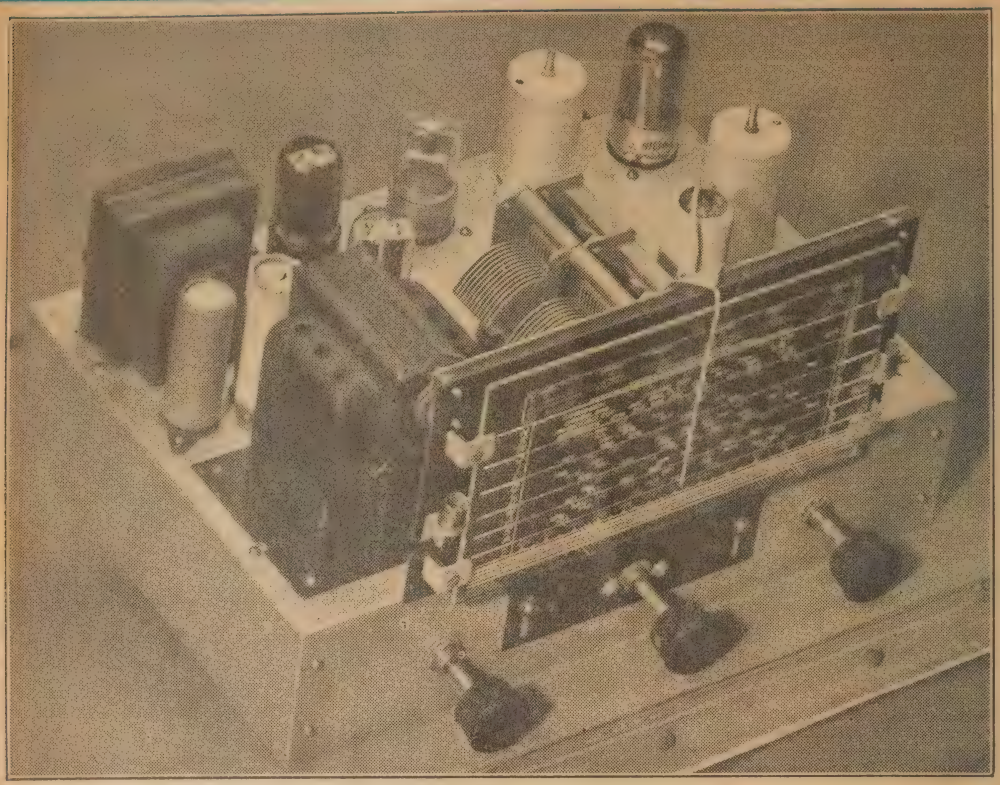
Technique was for the fighter to nose up behind the tanker, and manoeuvre this pipe into the end of the funnel. Sealed apparently by the pressure of air on the funnel, fuel then was passed through the pipe at the rate of about 200 gallons in six minutes.

All this went on at 250 mph! It all looked so simple. When the job was done, the fighter just eased back until it disengaged the fuel line, and banked off about its business.

The stunt is more than just that because those fighters use plenty of fuel. They are three times as useful if they can refuel in the air.

---

*The photo-electric cell was once used in a spectacular way at the opening of an American exhibition. The tiny light of the star Arcturus was picked up by the electric eye and the energy utilised to work relays which switched on the whole lighting system in the grounds and pavilions.*



The controls, left to right, are Volume, Tuning, and Wave Change switch. Otherwise the layout is similar to the broadcast version.

Here is a sensitive and selective dual-wave receiver that you can build and make perform as well as any commercial job, even if you have never built another set in your life. Apart from entertainment on the broadcast band, this set will bring world events and overseas programmes direct from where they happen to your living room via the shortwave bands.

# A SIMPLIFIED DUAL WAVE SET

by Maurice Findlay

OUR scheme for making set-building easy is now well under way, having brought forward an unprecedented response, not only from readers but from the radio trade in general. Kits for the Simplified Superhet, the Pentagrid Four and the Standard Multimeter are now available at all leading radio supply houses complete to the last solder lug and grid clip.

## ANYONE CAN BUILD

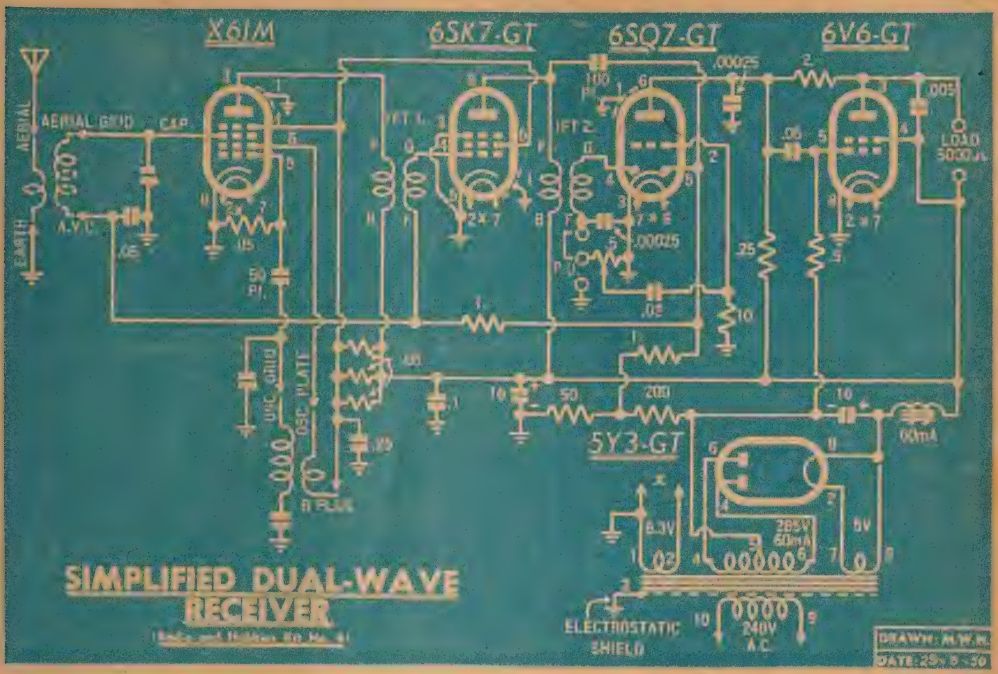
With these kits and our complete constructional articles the radio set-building hobby is brought within the reach of everybody.

All you need is an average intelligence and a little practice with the soldering iron. There is no reason why anyone who has played with a meccano set could not build up any one of the kits described and make it perform as well as did the original in our own laboratory. And you can take our word for it that each of these items performs just as well as the equivalent commercial job.

The R & H Kit No. 4 is a really good domestic receiver for the average suburban location where a-c power is available. Similarly, the 1950 Pentagrid Four is a standard set for where there are no power mains, while the Standard Multimeter is the first item of test equipment which every experimenter should acquire.

Both receivers are standard broadcast jobs, but many listeners are keen to include shortwave in the household receiver. Programmes from powerful shortwave transmitters all over the world pour into this country every hour of the day and night and a set that can receive them literally brings the world into your living-room.

# CIRCUIT DIAGRAM FEATURES DUAL-WAVE SET




The circuit diagram can be considered as basic for this type of receiver.

From the point of view of the constructor a modern dual wave receiver is no more complicated than an ordinary broadcast job.

## COIL UNIT

To switch from broadcast to short-wave it is necessary to change the aerial and oscillator coils, and this is generally accomplished by means of a switch. You can, of course, buy the four coils, trimmers and switch separately and wire them together yourself, but manufacturers have simplified the job by making available a wired and assembled dual wave unit consisting of four coils, a switch and all the required trimmers.

All that is necessary is to connect the appropriate leads into the circuit and the set cannot help but work. Actually, as far as the constructor is concerned, the wiring is simpler than a straight broadcast job.

The complete wired and tested unit costs about the same as would the components separately.

The chassis used for our new set (Kit No. 4) is exactly the same as is used for Kit No. 1. No extra holes are necessary, since the dual wave unit is mounted by a single lock-nut, which also secures the switch shaft. In this case it is convenient to mount the dual wave unit on the right-hand side of the chassis and the volume control on the left.

## MOUNTING

We suggest that you choose a type of coil unit which is mounted by the control shaft, but if you have any particular preferences there is no reason why another type of coil unit could not be used, provided it will fit. The worst that can happen is that you will have to drill some extra holes in the chassis. Apart from the particular unit you use, it is important to make sure that it is firmly mounted as there is nothing more annoying than an unstable receiver.

When mounting or handling the dual wave unit be very careful of the fine connecting wires. The broadcast coil windings are made with multi-strand wire and their efficiency will be spoiled if even one of the fine strands is broken. Therefore, make sure that none of the leads connecting the unit into the set foul the fine wires.

By the way, certain of the coil

## PARTS LIST

1 Chassis 13" x 9" x 3".
1 Power transformer 285V per side at 60 mA, 6.3V 2A, 5V 2A.
1 Filter choke 60 mA.
1 Tuning condenser (2 gang, AWA or Stromberg).
1 Dual-wave dial to suit above.
1 Dual-wave coil unit.
2 I.F. transformers (medium selectivity).
5 Octal valve sockets.
1 4 pin socket.

VALVES

1 X61M, 1 6SK7-GT, 1 6SQ7-GT, 1 6V6-GT, 1 5Y3-GT.

CONDENSERS

2 16 mfd. 525PV. electrolytics, 1 .25 mfd. 400V,
1 .1 mfd. 400V, 1 .05mfd. 400V, 1 .05 mfd. 200V, 1 .005 mfd mica, 2 .00025 mfd mica.
1 100 pf., 1 50 pf.

RESISTORS

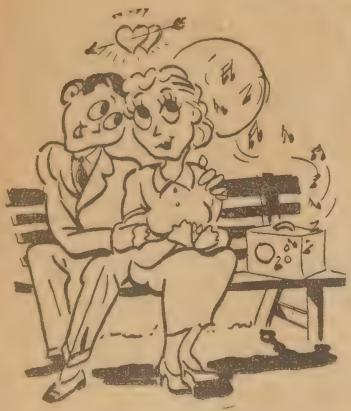
1 10 meg., 1 2 meg., 2 1 meg., 1 0.5 meg
1 0.5 meg. pot., 1 .25 meg., 3 .05 meg.,
1 .05 meg., ½ watt,
1 200 ohm 3 watt wirewound, 1 50 ohm 3 watt wirewound.

SUNDRIES

5 Terminals, 3 knobs, 1 grid clip, 3½" length resistor panel,
1 5 tag mounting strip, 1 3 tag mounting strip, power flex and plug,
1 4 pin speaker plug, approx. 20 inches of shielded hook-up wire, length plastic hook-up wire, nuts and bolts, solder lugs, etc.

# *Holiday Time*

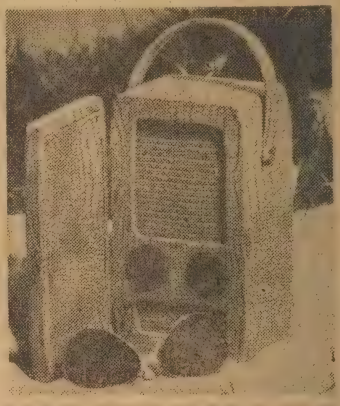
# IS PORTABLE TIME



*Christmas is just around the corner, the holiday spirit is afoot. Make it a really happy time with a portable radio. Get the added thrill of building your own.*

## *BUILD IT YOURSELF!*

It's quite simple, provided you build to a tested and tried circuit and use only the very best components. Electronic Parts kits are compiled to specifications laid down by "Radio & Hobbies" and only the very best quality components are used. *EVERYTHING* necessary to build a first class portable is included with each kit.



## CARRY SET

The smartest in small portables. This 4-valver is extremely simple to construct and is most efficient in performance. Note the smart lines of cabinet, size of which is 8½" high x 4½" wide x 4" deep. Originally described in "R. & H", October, 1949.

**Price for Kit complete with Valves, Cabinet and ALL necessary parts, £11/19/0 (Plus Postage).**

## *SENIOR PORTABLE*

Originally described in "R. & H." for December, 1948, this 5 valve B/C portable, with R.F. Stage uses either 6" or 7" speaker. A kit of parts for an A.C. power supply is also available. Cabinet size of portable 12½" x 8¼" x 6½".

## *HANDIE-TALKIE*

("R. & H." Oct., 1947, and Dec., 1947). The smallest possible 5 valve portable. Ideal for distance-getting, combined with compactness. A four valve version also available in the same cabinet. Size 7" x 4½" x 5".

## *SPRINGTIME PORTABLE*

("R. & H." Oct., 1946). A sturdy 5 valve portable with R.F. Stage which will take any amount of hard work. Cabinet size, including hinged lid, 13" x 8 5-8" x 5½".

## *MULTI-TALKIE PORTABLE*

("R. & H." July, Aug., 1948). As its name implies, this is a multi unit portable. It is available as a small 4 valve B/C portable and, in addition, an A.C. power unit can be built to enable it to operate from the A.C. mains, or a vibrator unit can be built to enable it to operate from a wet battery. Size of portable cabinet 7" x 4½" x 5¼".

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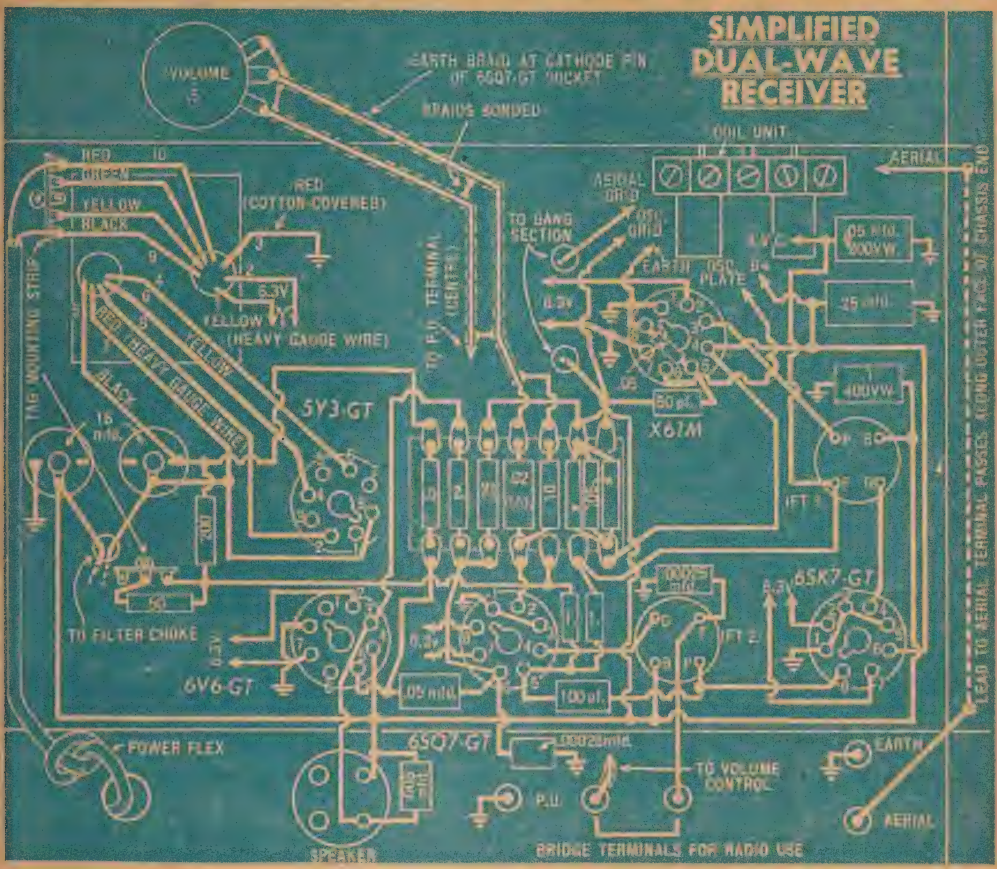
**KIT SET SPECIALISTS**

# UNDER CHASSIS WIRING OF DUAL-WAVE SET




This diagram shows the position of componets and methods of wiring. Study it carefully together with the circuit.

units are color coded by means of paint spots on the various connecting leads or switch points, and it is a good idea to make a note of the connections so that, should the coding be removed by the heat of the soldering iron, it will still be possible to identify the connections for the purposes of circuit checking.

Although, up to date, we have been discussing the coil unit, since much of the interest in the set centres around it, in actual practice it is one of the last items to be mounted on the chassis.

## ASSEMBLY

When you unwrap your kit from its packing case spread all the components out on the table or your workbench. Make sure that you can identify everything from the parts list and wiring diagram. This should not cause you any undue difficulty, since all condensers have the values marked and you can check resistor values from the standard color code.

The first stage of the assembly is to mount the five octal-valve sockets and the four-pin socket for the speaker. The wiring diagram will guide you as to how to position them.

## SOCKETS

Some sockets are provided with a tinplate mounting clip and are bolted to the chassis with two 1-8 in. bolts, while others, known as manufacturers' type, are held to the chassis with a circular spring clip which is crimped to provide the necessary tension. The latter may prove a little troublesome at first, but you will get the knack of it after the first couple of tries.

Your chassis will have a hole on either side of the converter valve which is not used. If cover plates are not provided, you can manufacture a pair from scrap aluminium and bolt them into place. The plates are not necessary from an electrical point of view, of course, but two empty holes spoil the neat appearance of the finished set.

Sprayed steel chassis cannot be depended upon for good earth connections so that it will be necessary to run a length of tinned copper wire around all the earth points. Therefore, before going any further make sure that there is a solder lug at each earth symbol marked on the diagram.

## EARTHING

However, use your judgement in this matter. For instance, there are two earth symbols adjacent to the X61M socket, but one solder lug would be adequate for the purpose. If you are using sockets with tinplate mounting plates, these will make convenient earth points in many cases.

Mount the tuning gang and the two IF transformers and include them in the earth systems by placing a solder lug under one mounting bolt of each. The filter choke is

# Goldring RECORD PLAYER

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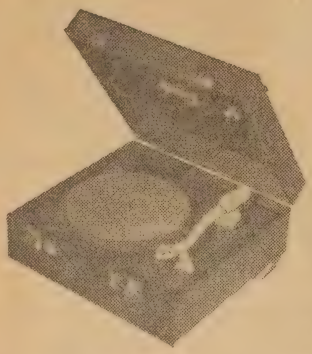

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HIGHEST FIDELITY REPRODUCTION.
Easy change from 78 rpm to 33⅓ rpm by simply changing color coded stylus and moving weight adjustment.

OUTPUT : 150 mV.
FREQUENCY RANGE : 30—16.000 cps.
STYLUS PRESSURE : 14 grms (78 rpm)
7 grms (33⅓ rpm)
OPTIMUM LOAD : 50.000 ohms
SAPPHIRE STYLI (supplied with PLAYER)
BLUE : 0.003" for Standard Records
YELLOW : 0.001" for 33⅓ rpm Records
REPLACEMENT STYLI : 15/- each
Also available GREEN : 0.0025"
ORANGE : 0.0035"

PLEASE NOTE: The unique design of this PICKUP using stylus as ARMATURE does not permit use of other styli or needles.
45 rpm RECORDS when available will be played with same stylus and weight as 33 1/3 rpm record.

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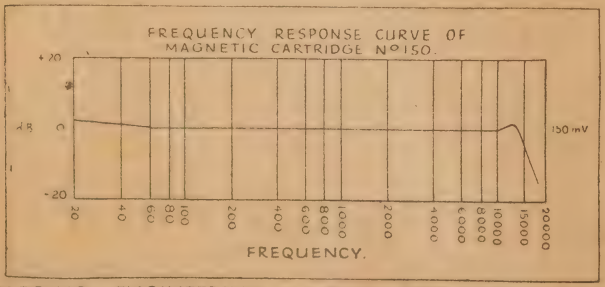


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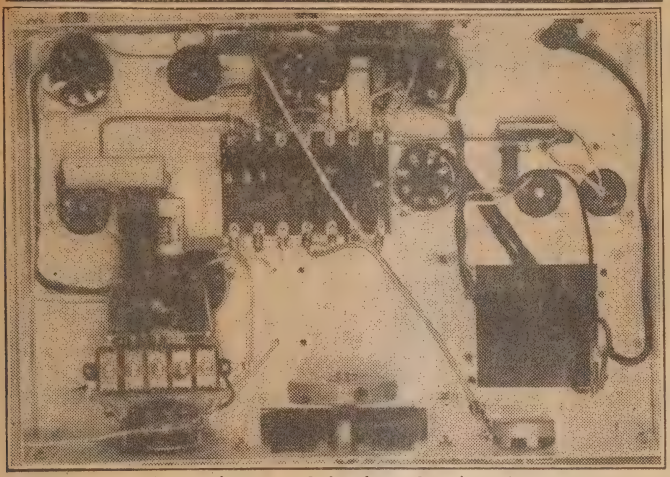
# LAYOUT UNDER CHASSIS



An actual picture of the chassis from beneath.

held in place with four 1-8in. studs. Tighten the nuts just enough to hold it firmly in place as it is quite easy to strip the threads.

## IF TRANSFORMER

The first IF transformer will have a lead protruding through the top of the can which is not required in this set. Snip it off about 1-8in. above the top of the can. If you are very careful not to break off the retaining lugs you can take the windings out of the can and snip the lead off short.

We have specified the transformer cut-out for a horizontal mounting power transformer, but either type can be used. With the horizontal type tighten the bolts down to the limit to ensure that the laminations will not vibrate.

The vertical mounting transformer which we happened to choose for the prototype set comes complete with a special adaptor plate and it is not necessary to drill any extra holes. The adaptor plate can be seen clearly in the above chassis photograph.

With the vertical mounting power transformer, the leads should be long enough to reach to the rectifier and the filament pins of the 6V6-GT. Twist each pair together for neatness.

It will be necessary to install a tag strip for the primary leads. Connect the unused tappings so that, should you need to change the supply voltage for the set, it will only be necessary to resolder a wire. Don't forget the rubber grommet for the power cord hole and tie a knot in the cord on the inside of the chassis so that accidental strain will not be concentrated on the tag strip.

## WIRING

After mounting the 3½in. length of terminal strip in the centre of the chassis, the five terminals and the volume control, you can proceed with the major part of the wiring. You will note that the coil unit and the dial are left until later because of the possibility of them being damaged.

As far as the wiring is concerned, concentrate on neatness with the supply leads—filament, high tension, screen and AVC—as an extra inch or two of lead is not of any particular significance.

Short. direct wiring should be the order of the day for all leads carrying signal currents, particularly those in the plate circuit of the mixer and IF amplifier, the grid circuit of the IF amplifier and the detector and AVC diode circuits.

## SHIELDING

Two audio leads in the receiver will require shielding. They are the lead from the terminal at the rear of the chassis to the "hot" side of the volume control and the lead from the centre of the volume control back to the .02 mfd. coupling condenser. Note that the shield braid should not be soldered to the cover of the potentiometer, but should be returned to a single earthed point near the cathode of the 6SQ7-GT.

Small components such as resistors and condensers are held in place by means of their own pigtail leads but take care, particularly in the case of the .25 mfd. condenser, that the leads are not so long that the components can flop around.

Incidentally this condenser and the .05 mfd. AVC bypass should not be installed until after the coil unit is in place, since the terminal lugs of the unit make convenient tie points.

Return the earth lead of the dual wave unit to earth with a length of tinned copper wire. You will probably find that it is convenient to make this connection near the X6IM socket.

The wire from the aerial grid lug goes direct to the front section of

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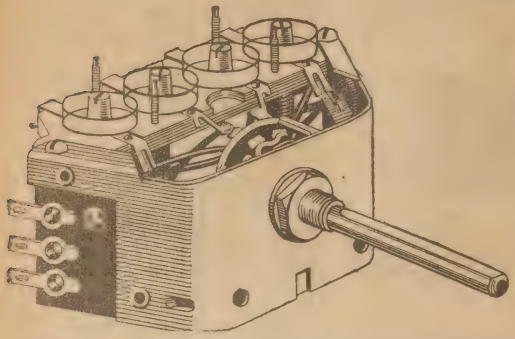

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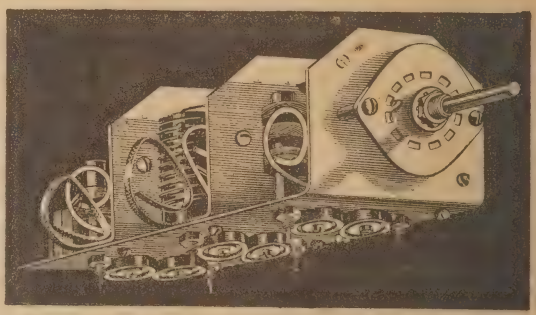

"Q PLUS"

**SPECIFICATIONS**

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Gang or Dial

**SHORT WAVE COVERAGE**
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the gang. Connect the aerial lug to the aerial terminal via the outside of the chassis, and the oscillator plate to pin 6 on the X61M socket by the shortest possible route, at the same time keeping it firmly in place and clear of the coils and fine wires in the unit.

Similarly, keep the oscillator grid clear of the unit and connect to the lug on the corner of the resistor strip near the X6IM. The 50 pf. condenser will already be in place. You can now install the lead from the lug to the rear section of the gang, and the only remaining lead is that from the front section of the gang to the X6IM top cap (not shown on diagram). Keep this as short as possible, at the same time allowing enough slack to make it easy to put the grid cap on.

Bolt the dial in place, but before doing so remove the screw which holds the drum to the frame of the dial. Take great care not to tangle the cord as it is a somewhat ticklish task to sort out a jumbled mass of fine dial cord. See that the drum is in alignment with the two pulleys near the top of the dial, otherwise the cord is likely to come off when the drum is turned.

After thoroughly checking the wiring, plug in all valves except the 5Y3-GT rectifier and switch on the power.

By this time your hands will probably be beginning to shake, but always remember that other people have been through the same experience—and survived!

If the four valves light up normally, and there is no indication of stress from the power transformer you can switch off again and plug in the rectifier and the speaker.

## FIRST TESTS

Failure to attend to the latter will damage the output valve so make sure that the speaker plug is always in place before the set is plugged into the power mains.

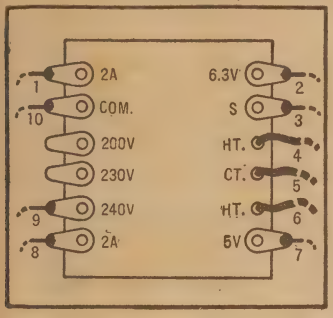
When you switch on again look between the rectifier plates and filament. If there is a continuous blue glow or flashing inside the rectifier switch off without delay and look for a short between high tension and earth.

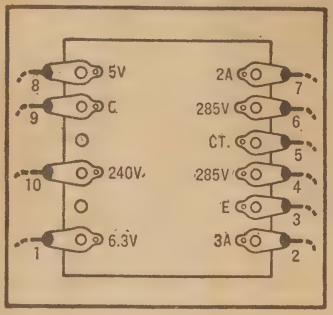
If you are sure that the wiring is correct, the first components to check are the two electrolytic condensers and the .1 mfd bypass from high tension to earth. Without a multimeter, the best you can do is to try disconnecting these components one by one until the short disappears.

If everything is in order, you should be able to receive some signals on the broadcast band, at least, although they may be weak and tune rather broadly, since the alignment will not be correct.

If, with an aerial connected, it is not possible to tune in a signal of any sort, you can take it for granted that there is an error somewhere, unless, of course, you are in a poor location and have reason to believe that the trimmers and slugs have been maladjusted since leaving the factory.

We will discuss the method of alignment later, but a few remarks will be welcomed by those who have already built Kit No. 1, and would now like to include the dual-wave unit.




You may wish to use an alternative type of power transformer with a terminal board attached. The layout of two popular types is illustrated above, with their normal markings and the leads numbered to correspond with the wiring diagram on page 31.

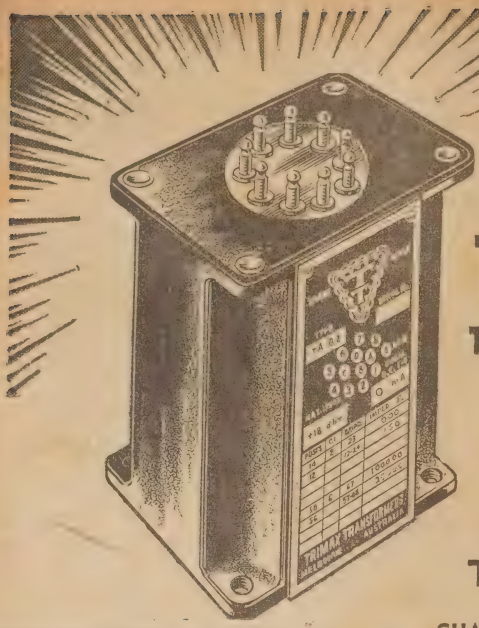
## MODIFYING KIT No. 1

First, remove the volume and tone controls, replacing the latter in circuit with a 0.5 meg. resistor. Also remove the aerial and oscillator coils and the two trimmers soldered to the gang condenser. Mount the volume control on the opposite side of the chassis and reconnect the shielded leads. They will probably be a little short, and the easiest way may be to install completely new leads.

Transfer the high-tension end of the three .05 meg. resistors to the adjacent vacant lug on the resistor strip, clearing the end lug for the oscillator wiring. Bolt the two metal plates to cover the holes previously occupied by the aerial and oscillator coils and then you can go ahead with the wiring for the coil unit as per the suggestions given earlier in this article, except that you may have to slightly alter the positions of the .25 mfd. and .05 mfd. bypass and the 50 pf. oscillator grid condenser.

The exact alignment procedure you adopt will depend on the type of dual-wave unit you have. However, it is most likely to have air-cored coils and five trimming condensers. We will discuss this type of unit first, and then outline the procedure with iron-

(Continued on Page 99)



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# FROM THE SERVICEMAN WHO TELLS

**Again this month, the Serviceman's columns are thrown open to his accountant friend, whose object in life, at this moment is to help you keep books straight. Let us know if you find these articles helpful.**

by C. H. Pearce AICA

LAST month I introduced you to the use of the most "important" of all books of account—the Cash Book. This month we will discuss the use of the most "revealing" book of account—the Ledger.

I have assumed thus far that all your transactions were cash transactions. That is, that you paid immediately by cheque for all goods &c, you received, and that all your customers gave you spot cash for any articles you sold them or work you did for them.

If you could persuade all your business associates to continue dealing with you in this way your trading transactions and the recording of same would be very simple. You would have no worry over outstanding accounts.

However, whilst such a state of affairs is very desirable, modern business methods demand that you enter into transactions other than for cash ie, "Credit transactions."

## CREDIT ACCOUNTS

This means that, as your business gets under way, you will be entering into contracts with people for the purchase and sale of goods and services, the payment for which will be made at a later date.

Before you give "credit" to anyone, make sure of their ability to pay. You can do this by asking for references from other firms from whom they have bought on credit. This reference is usually obtained verbally by ringing the firms concerned. If a large amount is involved it may be wise to obtain a written reference and even necessary to check with the bank with which they deal.

We will discuss this question of credit more fully in a later article. Let us for the present confine our attention to the use and keeping of the ledger.

The main advantage of the ledger lies in the fact that it provides a running record (or history) of each item of account.

## THE LEDGER

You will recall that last month, we took out a statement of Affairs which showed us the month's income and the expenses incurred in earning that income. You could manage quite well by taking out a similar statement each month throughout the year, but would find it rather cumbersome to have to go through twelve statements to find out the amount of say your purchases for the year.

How much easier it would be to go to one page and there see set out in chronological order your purchases for the twelve months. And that is just what the ledger does give you — a complete historical record of each item.

This is so because each purchase is recorded in the Purchases account, each amount spent on advertising is collected in the Advertising Account, a record of all amounts spent on lighting find their way into the Power and Light Account and so on.

Here we have the application of our Double Entry Bookkeeping system which is simple, self-checking and ideally suited for you, the radio serviceman.

To refresh your memory, I reiterate that the significance of the word "Double Entry" is that, every time you make a transaction, you record two entries in the books. Up to date in our bookkeeping we have made only one entry. We shall now proceed to make the second or "double" entry.

## DOUBLE ENTRY

This is done by "Posting" from the Cash Book into the Ledger. "Posting" merely means transferring from one book to another. It is governed by the first rule you learnt viz. "Debit whatever is received."

Concerning the book itself it is worthwhile spending five or six shillings on a well-bound book preferably with an alphabetical index in the front. If you cannot get one with an index leave the first one or two pages and make up your own index. An index may seem superfluous when you are first starting out, but as your business grows it will save you a lot of time turning over pages looking for the right account.

Allow a separate page for each account. In the case of Purchases and Sales, it may be a good idea to leave two pages. Next write up your index. Having done this you are now ready to commence Posting. Figure 1 shows you a typical layout of a ledger. The ruling is like a small cash book. The debit and credit sides are on the one page, and usually there is only one money ruling for each. You will find this quite sufficient. In Figure 1 all the accounts appear on one page for convenience, but they will of course be on separate pages in your ledger.

We shall commence posting from the "Receipts" side of the Cash Book. The first item is Capital. The bank received this amount of £200 and consequently was debited. Who gave the money? You did and so you have to be credited.

An account is opened in the ledger "Capital Account" or if you prefer "R. Jones Capital Account." In this case R. Jones would be yourself.

On the credit side of that Capital Account we make an entry dated October 1. By cash indicating that it came from the Cash Book, and the amount of £200 which is the same as shown in the Cash Book.

The next posting is a sales item. Here you can see the advantage of having a separate column for sales in the Cash Book. There are a number of transactions during the month which affect the sales account, and which would have to be posted individually. Instead only one posting of the total sales for the month is required.

To post this item you post the total of the sales column, £82.

The bank received the money for the sales and it is debited, therefore the Sales Account must be credited. The date, October 30 is entered because this posting represents all the sales for the month. The detail is "By Cash" and the amount £82. You will see the entry in the Sales Account of the specimen ledger (Figure 1.).

Next we come to service. Here again only one posting is necessary. The amount of £18 is entered on the Credit side of Service Account. The particulars are By Cash and the date is again October 30.

## EXPENDITURE

This completes the posting of the debit side of the Cash Book, and if you check over your entries you will see that you have entered a total of £300 on the credit side of your ledger. So far your Double Entry is correct.

We now turn to the Expenditure or Credit side of the Cash Book. We see that the first item is Purchases, and that it has a separate column. Therefore, we can post the total purchases for the month in one entry.

As far as Purchases are concerned Cash was credited because Cash was given up for the Purchases. What account received the value? It was the goods that were purchases for resale and thus Purchases account is debited.

The entry appears on the left hand or debit side of Purchases account as follows:—Oct. 30. By Cash £100.

Salary is the next item to be posted and this is transferred to Salaries or Drawings Account in exactly the same way. Strictly speaking, the salary you draw for yourself represents money taken from the business and should be debited to Drawings account, but for simplicity I have retained the word Salaries. If, as

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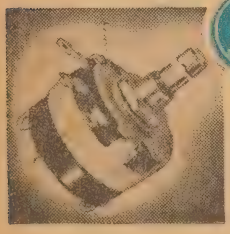

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your business grows, you should employ other people, then their wages would be debited to a Wages or Salaries Account. The salary you take out of the business would be debited to Drawings Account.

Now we come to the Sundries column. Here we have a number of items which have to be posted separately. The first is Furniture and Fittings, £30. Cash was given up for these fittings and so cash was credited. We again ask ourselves what account received the value. The answer is Fittings, therefore the Furniture and Fittings account is debited. Turn to Figure 1 and trace the entry through.

Also on October 2 Cash (£30) was expended on test instruments. In this case the account which is debited is called Plant Account.

Next to be posted is Rent, £5, then Advertising £3. Telephone £5 and Lighting £2. When all these accounts have been debited our postings from the Credit side of the Cash Book are complete. Check them over, they should total £195.

## FOLIOS

For the sake of accuracy it is always wise to have a key to your posting. Alongside the money column in your books of account you will notice a narrow column about ¼" wide. This is known as the "Folio" column. "Folio" is merely the bookkeeper's way of saying page number. In this folio column you write the number of the page in the book from which you have posted. When you are posting from a book you will write in the folio column the page number of the book to which you are posting. nd, in fact,

In the case of the C it comes to the Capital item you ve, no fundameaning Ledger Page 1 97 cannot be column, which means that ra have posted that amout to Page 1 in the Ledger.

At the foot of the Sales and Service column you will write the appropriate ledger numbers, indicating that you have made postings to these pages. The same will apply to the credit side of the Cash Book, and the same system will apply to the Ledger.

In the Ledger you will show the page number of the Cash Book from which you have made the postings. For example, in Capital Account in

## TRIAL BALANCE

| ACCOUNT | Dr. £ s. d. | Cr. £ s. d. |
|---|---|---|
| Capital | | 200 0 0 |
| Sales | | 82 0 0 |
| Service | | 18 0 0 |
| Purchases | 100 0 0 | |
| Salaries (or Drawings) | 20 0 0 | |
| Furniture and Fittings | 30 0 0 | |
| Plant | 30 0 0 | |
| Rent | 5 0 0 | |
| Advertising | 3 0 0 | |
| Telephone | 5 0 0 | |
| Power and Light | 2 0 0 | |
| Bank | 105 0 0 | |
| | 300 0 0 | 300 0 0 |

FIG. 2.

# LEDGER PAGES

Page 1
### CAPITAL ACCOUNT

| | £ s. d. |
|---|---|
| Oct. 1. By Cash . . | 200 0 0 |

Page 2
### SALES ACCOUNT

| | £ s. d. |
|---|---|
| Oct. 30. By Cash . . . | 82 0 0 |

Page 3
### SERVICE ACCOUNT

| | £ s. d. |
|---|---|
| Oct. 30. By Cash . . . | 18 0 0 |

Page 4
### PURCHASES ACCOUNT

| | £ s. d. |
|---|---|
| Oct. 30. To Cash . . | 100 0 0 |

they ap... to job down to ... valves easily

### OR DRAWINGS ACCOUNT

| | £ s. d. |
|---|---|
| Oct. 30. To Cash . . . | 20 0 0 |

FIG. 1.

Page 6
### FURNITURE AND FITTINGS ACCOUNT

| | £ s. d. |
|---|---|
| Oct. 2. To Cash . . . | 30 0 0 |

Page 7
### PLANT ACCOUNT

| | £ s. d. |
|---|---|
| Oct. 2. To Cash . . . | 30 0 0 |

Page 8
### RENT ACCOUNT

| | £ s. d. |
|---|---|
| Oct. 2. To Cash . . . | 5 0 0 |

Page 9
### ADVERTISING ACCOUNT

| | £ s. d. |
|---|---|
| Oct. 10. To Cash . . . | 3 0 0 |

Page 10
### TELEPHONE ACCOUNT

| | £ s. d. |
|---|---|
| Oct. 14. To Cash . . . | 5 0 0 |

Page 11
### POWER AND LIGHT ACCOUNT

| | £ s. d. |
|---|---|
| Oct. 25. To Cash . . . | 2 0 0 |

the folio column on the credit side you will write C1, meaning Cash Book, Page 1. This indicates that that is the page from which you have taken the posting.

A wise rule to follow when posting is to insert the folio number immediately after each item is posted. In this way, should you have to answer the telephone or be subject to some interruption, you can, upon returning to your books, see at a glance up to what point you have posted.

## TRIAL BALANCE

You will recall I stated last month that your records can be self-checking and that should an error occur it can be located without delay. This is achieved by the preparation of a Trial Balance, which is merely a list of the balances on the accounts in your ledger.

If you look at Figure 2 you will see that to make up a Trial Balance it is necessary only to write down the name of account and put down its balance according to whether it be "Dr" or "Cr." Add up both sides and if they total the same you have proved the arithmetical accuracy of your books. Figure 2 includes the balance of every account in our ledger, plus the balance brought forward in the Cash Book, viz. £105. Our debits and our credits total £300, therefore we know that our Double Entry bookkeeping is correct.

By reading through this article carefully you should understand thoroughly how to post from one book to another. You will have also realised the great advantage of having a ledger—the book which tells you the **"story"** of your Sales, Purchases, Expenses, in fact, every account for which you have entered into a transaction.

**(Continued on Page 51)**

Standard rack and panel mounting was used. Control at bottom right is a switch to bring in a 200 ohm cathode resistor for the 807's used when tuning up.

# A TRANSMITTER FOR 50 MC



**Before very long, the 50 mc. "DX season" is likely to be upon us, and the chances are that by the time this article appears, the band will have been open on more than one occasion. This transmitter circuit shows a simple way of putting 100 watts on the air with very little more trouble than that experienced with any other band.**

THOSE who have spent some time on the higher frequencies realise that the 50 mc band isn't really hard to use and, in fact, is almost scorned by the most adventurous as being too low in frequency altogether to be worth their while. It is, however, one of the most valuable bands in the whole amateur spectrum, because not only does it serve to introduce one to the world of tiny coils and easily made beams but it allows fundamentally the same circuits and often components to be used as are normally employed for the lower bands.

## LOCAL WORK

But what is probably the most important point, it is a really first-class band for local communication. That's a statement which has been made before, but only those who have used it know how true it is. Anyone in a reasonably high spot can easily cover the metropolitan area with signals ranging from good to terrific, and with quite low power. Because aerial elements are only about 9ft long a three-element beam is simple to make and quite easy to handle.

With anything like a good location, stations in Gosford, Newcastle, Canberra and even farther can frequently be worked. On metropolitan signals there is no interference, very little atmospheric noise, and no more car ignition interference than can be eliminated by a simple noise limiter. There is plenty of room on the band, and interference from other stations rare.

by John Moyle

And then, of course, around the summer period there are those tantalising days when interstate and New Zealand stations suddenly appear out of the blue at "local station" strength and all bedlam breaks loose. Yes, there is plenty on the 50 mc band, and no amateur who has spent a period working there will ever forget the fun he extracted from it.

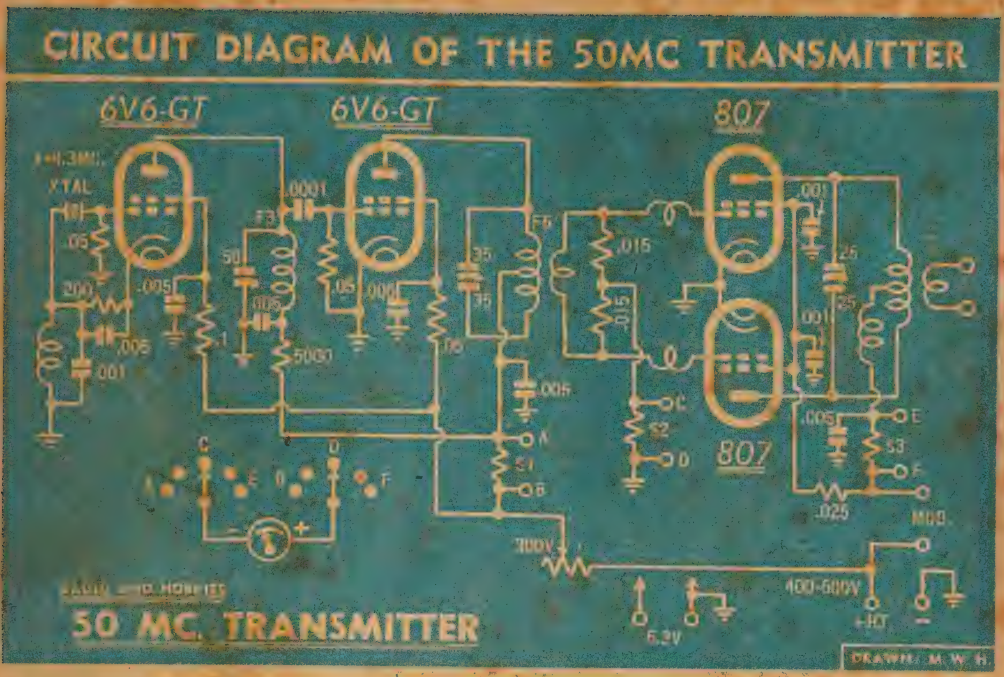
## USING THE 807

The transmitter to be described actually grew from the push-pull 807 design described in the 1950 Short Wave Handbook. It uses virtually the same circuit and parts, with only small modifications to layout and circuit values. It will run perfectly well with 100 watts of input and can be modulated for phone.

It has good efficiency, and the output is quite comparable with that obtained on other bands.

Some amateurs we know have had difficulties with the use of 807's on

## CIRCUIT DIAGRAM OF THE 50MC TRANSMITTER




The circuit is neither complex nor elaborate. Careful adjustment only is needed for good results. The cathode coil has 7 turns on a 1 inch former. Oscillator plate coil has 6 turns of 16 gauge 1¼in diameter spaced ¼in. Doubler plate coil has 5 turns 1¼in spaced ¼in. Final tank coil has 6 turns of 14 gauge wire spaced 1½ inches.

the higher frequencies and, in fact, on almost any band if it comes to that. There is, however, no fundamental reason why the 807 cannot be used on 50 mc. It has full ratings at that frequency, and although its internal wiring makes it less stable than on 14 mc, for instance, there is no reason why it should prove anything but satisfactory if one goes the right way about it.

However, let us consider the transmitter in general, and the 807's can be discussed later.

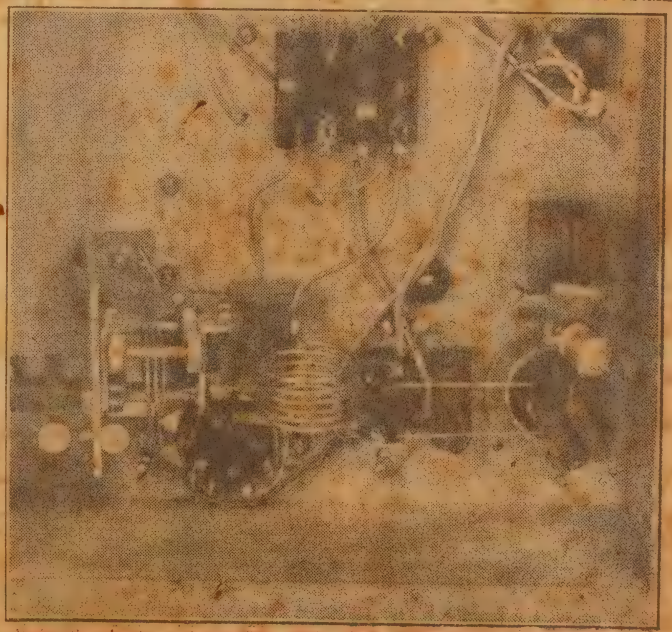
### INITIAL 6V6's

In the interests of simplicity and economy it is desired to use as few valves as possible. For this reason the transmitter commences with a crystal on approximately 8.3 mc and in two stages multiplies this up to 50 mc. To be accurate, 8.333 mc produces 50 mc and 9 mc produces 54 mc. Because most of the available crystals (generally from Disposals sources) lie between 8.3 and 8.6 mc most stations are found at this end of the band. The order of multiplication is, of course, six times.

This is accomplished by using some form of oscillator-multiplier tripling in the first stage, followed by a doubler to drive the amplifier. Experiments made over some considerable time lead us to believe that the Tritet circuit is about the best of all as an oscillator-multiplier and will produce more than enough output to drive a doubler to 50 mc.

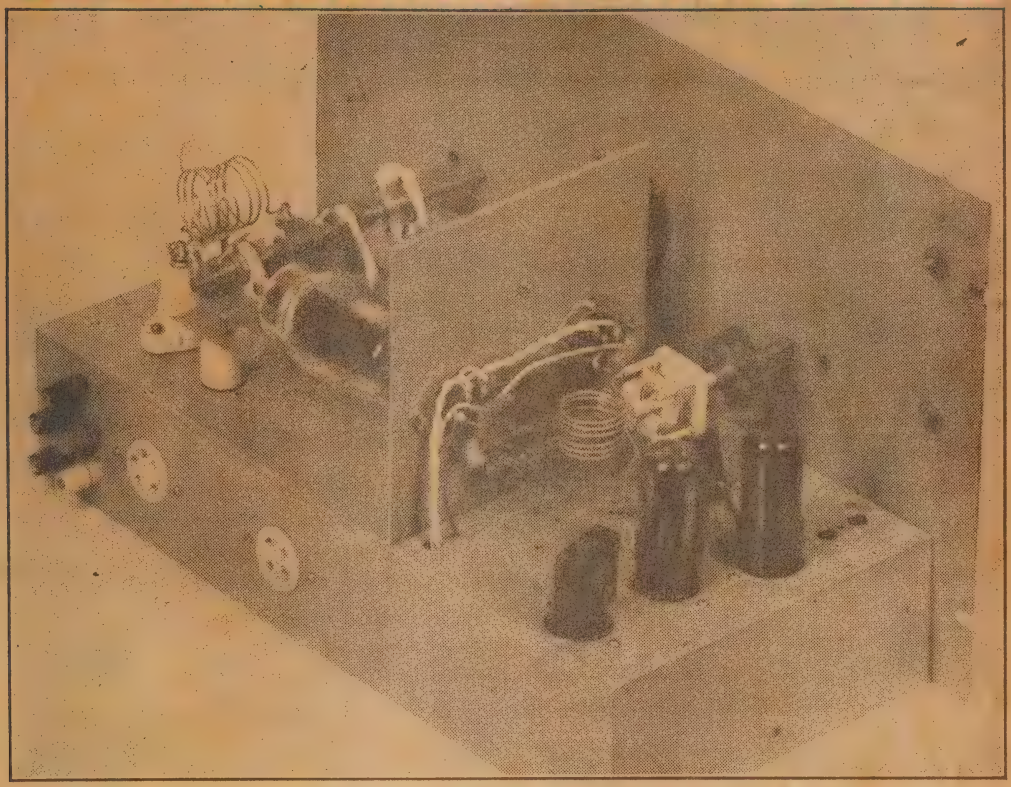
The valves used in these stages are 6V6s because, despite their maximum full frequency rating of only 11 mc, they appear to do a better multiplying job down to 50 mc than any other valves easily obtainable. Moreover, they are virtually impossible to "blow up" under reasonable overloads.

The reason for tripling in the oscillator is that it is not hard to obtain



Under the chassis at the oscillator end. Coil is on 25 mc. in the tritet plate circuit. The crystal socket is at right, oscillator at centre, and doubler at left.

# A REAR VIEW OF THE TRANSMITTER FOR 50MC



This rear view shows the doubler plate coil and condenser placed for convenient feed to the 807 grids. Grid leaks, chokes and screen bypasses for the 807's are mounted at the sockets.

enough output to drive a second doubler valve, but quite hard to get enough from the second valve as a tripler to drive the final, no matter how much output is available from the oscillator doubler.

## VOLTAGES

The Tritet is therefore operated at quite modest voltages—about 150 on the screen and 250 on the plate—with enough output to produce about 1 mill current in the tripler grid circuit.

It is rather important to avoid pushing crystals on 8 mc as many will have found. Overheating, arcing, and even fracture from high grid current can be quite a problem. In our circuit, however, no 8 mc crystal has refused to function, and most of them were home ground to frequency.

The secret in adjusting any Tritet circuit is in the cathode coil. This must be tuned to a frequency higher than the crystal and, in fact, to as high a frequency as possible consistent with good output. As this circuit approaches the adjustment at which oscillation abruptly ceases, the output certainly increases. But just before oscillation stops there a period of very high crystal current, which might cause damage unless avoided.

If, therefore, you use the voltages shown in the circuit, and keep the cathode circuit tuned to the highest practical frequency, you should not only drive the doubler adequately, but operate your crystals quite safely. If higher plate voltage cannot be avoided, see that the screen does not exceed about 150 volts. It is high screen voltage which really does the damage.

The doubler stage is really the heart of the transmitter because, unless it is operating properly, there will not be enough drive for the final stage.

## GRID CURRENT

Assuming that the transmitter is to be modulated, we will require, according to the makers' figures, 8 mills of grid current with grid resistors of 22,000 ohms each.

In practice, however, it is possible to reduce the amount of drive represented by this grid current quite a bit before the 807's begin to misbehave, which misbehavior generally takes the form of "downward modulation," as it is sometimes called. We have found the minimum grid current for two valves to be about 4 mills if they are modulated, although one can sneak as low as 2 mills and still get away with it without modulation, even if it does sound like murder!

## GRID CURRENT

In practice, it should be possible to get 5 to 6 mills grid current from the doubler with 22,000 ohms resistance without manhandling the 6V6. In our case, we compromised between bias requirements for phone and CW, and dropped the grid resistors to 15,000 ohms. The grid current should now be getting on to 8 mills for both valves, and the stage should modulate quite satisfactorily.

In order to get this amount of drive, one must do a little coaxing, not only with the valve, but with the tuned circuits also.

The first thing is to provide adequate drive for the doubler. This isn't hard to do, fortunately, and apart from using as much inductance as possible in the Tritet plate coil, it needn't trouble us further. We have already specified voltages for this valve as being about 150 screen and 250 plate.

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Type A. Circular 2¾" dia. Graduated 0-100 through 180 degrees .. 1/6

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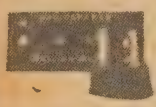
## MINIATURE 2 PIN PLUGS & SOCKETS



The ideal connector for speakers, pick-ups, etc. Rectangular socket is 1 5-8" x ¾". Plug is polarised, so cannot be inserted incorrectly.

**1/6 per plug and socket.**

## CLIX PLUGS & SOCKETS

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**Socket 7½d. Short Plug 7½d. Long Plug 9d.**

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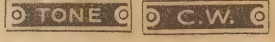


Dress up your equipment with these plates — Black with brass lettering. Size 1¼" x ¼"—In the following titles:

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| B.F.O. | Power |
| Buffer | Power-amp |
| Crystal | Record |
| Current | Radiation |
| C.W. | Receive |
| Doubler | Rectifier |
| Earth | Regeneration |
| Filament | Short-wave |
| Focus | Selectivity |
| Gain Grid | Selector |
| High | Speaker |
| Input | Sweep |
| Intensity | Sync. |
| Key | Tone |
| Low | Transmit |
| Microphone | Tuner |
| Milliamps | Volts |
| Mixer | Vernier |
| Monitor | Volume |
| Modulator | Wave Change |
| Neutraliser | X Shift |
| Off-On | Y Shift |
| Ohms | X Amp |
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| | B Battery C Battery |

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| 16 | five | 3/3 |
| 17 | six | 4/- |
| 18 | six | 4/- |

17

24 22

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| No. | Lugs | per doz. |
|---|---|---|
| 22 | two | 1/6 |
| 23 | three | 2/- |
| 24 | four | 3/- |
| 25 | five | 3/6 |
| 26 | six | 4/- |
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28

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# Price's RADIO

**5 & 6 Angel Place**
**SYDNEY**

We will have to run the doubler harder than this, and with a screen voltage of 250, the plate should be at least 300, and up to 350 for full output.

Once again we should strive to use a large plate coil, remembering that it must also provide the out-of-phase voltages to drive the 807 grids. We found it most desirable to use a split-stator condenser to assist here, as this coil is subject to loading not only by the output capacitance of the 6V6, but also by some at least of the extremely high input capacitances of the 807's. We just can't afford, therefore, to add more circuit capacitance other than that required for tuning.

For the same reason, capacitive coupling from the ends of the centre tapped coil to 807 grids is impracticable, unless the coupling condensers are tapped well down the coil to avoid this capacitive loading. The actual tapping point for maximum drive and minimum loading is quite critical, and requires some form of variable coupling condenser.

## COUPLING

A much simpler idea, and one which gives easier adjustment, is to couple the grids to the doubler tank with a couple of untuned turns of insulated hookup wire inserted at the centre of the tank coil. This method gives as much drive as obtainable from capacity coupling and much less loading from the 807 grids.

Some designers advise tuning the 807 grid circuits and inserting the untuned coil in the doubler plate circuit. Frankly, we don't think there is a great deal of difference, and either method should provide similar results.

The coupling coil is pushed into the tuning circuit until any further coupling begins to affect seriously the tuning of the tank coil. Generally speaking, this critical point will coincide with the greatest 807 grid current.

Two separate grid leaks have been used, because it is very awkward to use a single resistor from the centre-tap of the coupling loop. It is almost impossible to find the exact centre point of this loop, anyhow.

The grid leak values are far too high to have any shunting effect on the tuning coil.

## DOUBLER OUTPUT

In brief, therefore, adjustment of the doubler stage means socking the grid with as much drive as the Tritet can offer without exceeding the stated voltages, putting plenty of volts on the doubler up to the limits mentioned, using low-C tuning circuits, and taking care with the coupling into the 807 grid circuits.

The layout allows for the Tritet coils to be accommodated under the chassis, and the doubler plate coil above it, right up against the 807 sockets. This means plate connections a couple of inches long, but these are much preferable to long leads in the actual tuning circuit. Tuning coils and condensers should

(Continued on Page 99)

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***High Resistance D.C. Voltmeter***

0 to 3v 0 to 10v 0 to 30v
0 to 100v 0 to 600v 0 to 1800v

***A.F., R.F., and U.H.F. A.C. Ranges***

with internal diode or external probe.
0 to 3v 0 to 10v 0 to 30v
0 to 100v 0 to 600v

***Resistance*** five ranges from 0.2 ohms to 1000 megohms.

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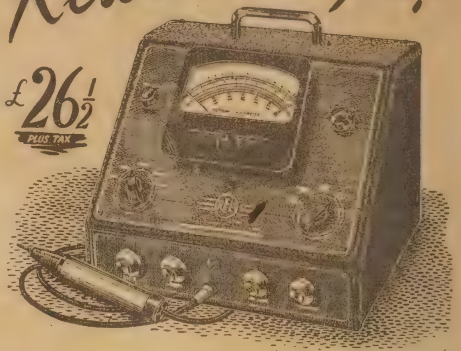


**N.B. Developed by specialisation, the Robinson Electronic Multimeter is individually constructed and not mass produced. With each instrument is a written guarantee which covers all components for a period of six months.**

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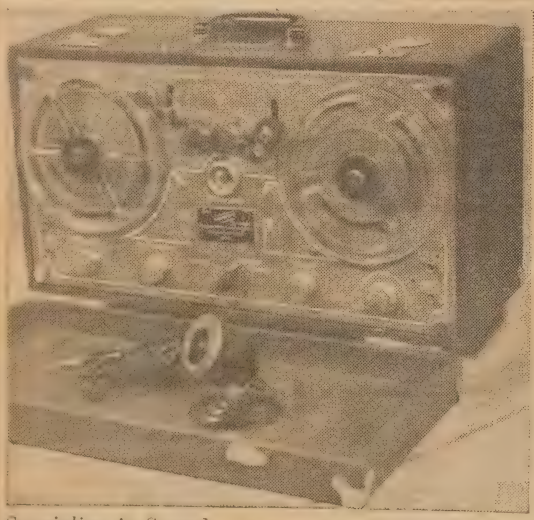

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# FOR THE JUNIOR EXPERIMENTER

**No junior radio man will get very far without a good knowledge of meters and their uses. This month we let the "Aerovox Research Worker" take you most capably through the paths of meter theory. The article follows aptly on the multimeter in the September issue.**

ALTHOUGH the d.c. meter is a standard tool around the laboratory, service bench or "ham shack," its usefulness may be greatly enhanced by a better understanding of the principles underlying its construction and applications.

Despite the fact that the judicious use of electrical instruments is an unfailing hallmark of the skilled electronics technician, there is a tendency on the part of many to accept the meter at its face value without ever gaining an intimate knowledge of its internal functioning.

Actually, a complete familiarity with the capabilities and limitations of the d.c. meter can be gained only through a study of its electrical and mechanical characteristics. This paper will discuss these characteristics and point out certain precautions to be observed in the use of such measuring instruments.

Because the moving-coil, permanent-magnet type known as the d'Arsonval meter forms the basis of about 90 per cent of the meters in common use, being used to measure current, voltage and resistance with different auxiliary circuitry, the present discussion will be restricted to this type.

## D'ARSONVAL MOVEMENT

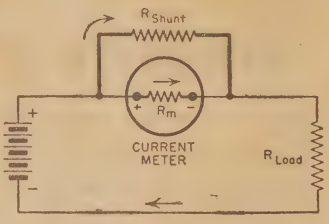
The fundamental principle of all general types of electrical meters is the same; the electrical quantity to be measured is converted into a mechanical motion which is calibrated in terms of that electrical quantity by means of a scale and pointer. In the d'Arsonval type, direct current flowing in the turns of a coil suspended in a steady magnetic field produces an electromotive force which rotates the armature against the counter-torque of a hair spring—by an amount proportional to the current flowing.

A light pointer attached to the armature indicates the rotation of the coil, and therefore the current value, on a semi-circular calibrated scale. Figure 1 illustrates the usual form of this arrangement.

The current-carrying coil is wound on a lightweight frame or armature which, in turn, is supported between sapphire-jewelled pivot bearings which allow it to rotate freely. The electrical connections to the coil are made through spiral hair-springs at each end of the armature.

These fine alloy springs perform several vital functions. Besides providing the current-carrying path between the armature and the stationary parts of the meter, they provide the counter-force against which the meter torque or rotational force acts, as well as supplying the restorative force which returns the pointer to zero when current ceases to flow.

The coil thus mounted is immersed in a strong magnetic field which is usually provided by a permanent magnet. The stability and permanency of this magnet are of




$$R_{Shunt} = \frac{R_m}{(N-1)}$$

$R_m$ = Internal meter resistance.
N = Desired scale multiplying factor.

USE OF SHUNT RESISTANCE TO EXTEND CURRENT-METER RANGE
FIG. 2

importance, as well as the uniformity of the magnetic field produced between its poles.

The pole tips are usually semi-circular in shape to fit closely around the moving coil. The uniformity of field is greatly improved by the use of a cylindrical core of soft iron mounted in the centre of the armature so that the moving coil revolves around it.

The indicating pointer is affixed to the armature at one end and a system of small adjustable counter-weights is used on the tail-piece and cross arm of the pointer to balance the complete armature assembly. The angular movement of the moving coil assembly is restricted by a set of cushioned stops.

The completed assembly is extremely delicate and precise. It is interesting to note that most of the components serve several purposes. For instance, the armature frame not only provides the form upon which the current-carrying coil is supported but is also a closed-loop conductor in which eddy currents are induced which oppose the motion of the armature and so provide *damping* of the meter movement. Excessive over-swing or oscillation of the pointer is thus avoided.

## THE CURRENT METER

Essentially, the d'Arsonval meter is a current measuring device. The flow of current through the moving coil sets up a magnetic field around the coil which interacts with the fixed field produced by the permanent magnet to cause rotation of the coil.

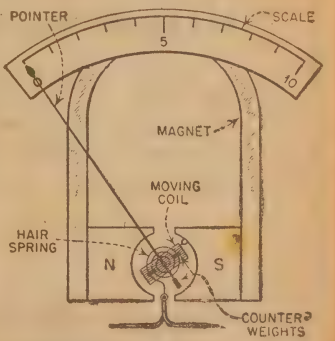
The turning torque developed is proportional to the strength of the permanent magnet, the number of turns in the coil, and the amount of current flowing in the coil. The pointer deflection which results is determined by the strength or counter-torque of the spiral springs. At any given meter deflection, the torque produced by the interaction of the current in the coil and the magnetic field is exactly equal to the counter-torque of the hair springs and an equilibrium results.

Since in any given meter design the current in the coil is the only variable, the deflection of the pointer is directly proportional to the amount of current flowing. The scale graduations in properly designed d.c. meters of this type are therefore linear.

## SENSITIVITY

The amount of direct current required to deflect the pointer to the highest graduation on the scale is called the *full scale sensitivity* of the meter. Instruments are manufactured in a wide range of sensitivities ranging from amperes down to a practical limit of about 20 microamperes. In addition to the above, high - sensitivity instruments are available with sensitivities of ½ microampere for full scale deflection. Such high sensitivities are achieved by the use of powerful permanent magnets, lightweight multi-turn coils, and very delicate hair-springs.

Meters having sensitivities of one milliampere or less may be used for measuring any larger value of cur-




ESSENTIAL PARTS OF D.C. METER
FIG. 1

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## *is Portable-time*

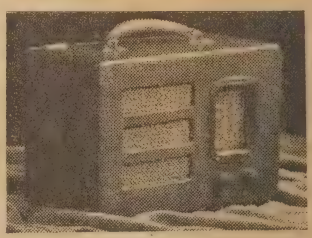
Add to your popularity this summer—complete your outings to the beach, etc. with your own home built portable radio set. These kits are easy to assemble and give outstanding performance.

### SPRINGTIME PORTABLE

This is not a new kit but has proved so popular over years we still recommend it for outstanding performance. Using RF stage, miniature 1.4v valves, large speaker for tonal quality and an attractive cabinet in leatherette. The complete set is only 13 x 8⅝ x 5½.

### SENIOR PORTABLE

Using miniature valves 2—1T4
1—1R5
and an RF stage 1—1S5 1—3V4
for improved performance under difficult conditions. A 6-inch speaker for improved tone.
Cabinet Size 12½ x 8¼ x 6½.



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### *BATTERIES*

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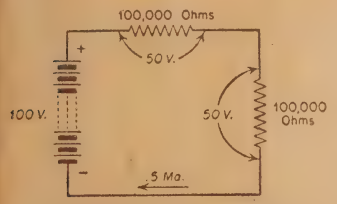
rent by the proper use of *shunts*. If a conductor having a resistance equal to the internal resistance of the meter is connected in parallel with it, the current will divide equally between the two paths and hence twice as much current will be required to give full-scale deflection of the meter.

If a shunt is chosen which has one-fourth the resistance of the meter coil, the currents through the parallel resistances divide in the ratio of 4 to 1, and since only *one-fifth* of the total current flows through the meter, its full-scale indication is multiplied by a factor of *five*.

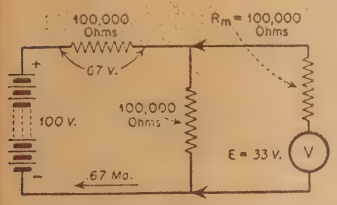
Figure 2 shows the connection of a shunt to a direct-current meter and the equation commonly used to determine the shunt resistance required to extend the scale by a factor N. The internal resistance of the meter may be determined from the published characteristics of that type, or by measurement. In multi-range instruments it is usual to select shunts which multiply the scale calibration by multiples of ten for ease in reading.

## D.C. VOLTMETER

The same basic movement which is used to measure direct current is also employed in voltmeters. In this




UNDISTURBED CIRCUIT CONDITIONS



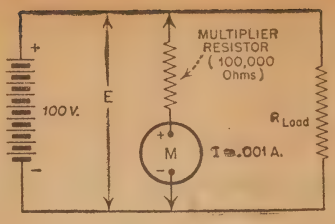

CIRCUIT "LOADED" BY VOLTMETER

FIG. 4

case, resistance is added in *series* with the meter in the manner shown in Fig. 3.

Such external *multiplier resistors* may be used with a high sensitivity milliameter or microameter to measure voltages ranging from millivolts to kilovolts. The meter is still performing its original function as a current measuring instrument, but in this case it is measuring the current which an unknown voltage causes to flow in a known resistance. The voltage is therefore determined by Ohm's Law (E equals IR) and the meter scale may be calibrated directly in terms of voltage.

Meters for voltmeter applications




E = IR = 100 Volts

USE OF D.C. METER AS VOLTMETER

FIG. 3

are classified according to "ohms-per-volt" ratings, ie, the number of ohms which must be contained in the voltmeter circuit for each volt which the meter is to indicate. For example, to limit a voltmeter using a one-milliampere basic movement to full-scale deflection when 10 volts is impressed, the total resistance of the circuit must equal 10,000 ohms, by Ohm's Law. A total of 15,000 ohms would be required for 15 volts full scale, &c.

Thus a .001 ampere meter one milliampere full scale is rated at "1000 ohms-per-volt." The same meter can be made to read 500 volts full scale by using a 500,000 ohm multiplier in series with it. In such cases, where the required multiplier resistance is very large, compared with the internal meter resistance, the latter is usually ignored since the error introduced is much less than the reading accuracy of the meter.

However, if it were desired to make a 1000 ohms-per-volt meter read 1 volt full scale, it would be necessary to include the meter resistance in the total value of 1000 ohms required. If the internal resistance of the meter is 100 ohms, the correct value of the multiplier would be 900 ohms since a 10 per cent error would be introduced if the meter resistance were neglected.

Since the voltmeter is always connected across the voltage drop being measured, it is important to use an instrument having a total resistance which is large compared to the circuit to which it is connected. Otherwise, serious inaccuracies result since a low resistance meter "loads" the circuit being measured so that the voltage drops indicated are not those which exist in the undisturbed circuit.

A simplified example of such misuse of the voltmeter is illustrated in Fig. 4. To reduce such errors, basic meters having full-scale sensitivities of 50 microamperes (20,000 ohms-volt) or 100 microamperes (10,000 ohms-volt) are used in high quality voltmeters.

## THE OHMMETER

Just as the d'Arsonval current meter is used to determine voltage when the current and resistance are known, it may be used equally well to read resistance by indicating the current which flows when a known voltage is impressed across an unknown value of resistance.

Such an instrument, calibrated directly in ohms, is called an "ohmmeter" and is widely used in a variety of circuit types of which Fig. 5 is a typical example.

In this circuit, a battery or other source of voltage is provided which is capable of producting a full-scale deflection on the meter when the test terminals (A and B in Fig. 5) are shorted. Variations in battery voltage and other circuit constants are compensated for by adjustment of a rheostat (R2).

If an unknown resistance is inserted between the test terminals, the meter deflection will be reduced proportionately. The meter scale can, therefore, be calibrated directly in terms of the external resistance required to limit the meter current to that value.

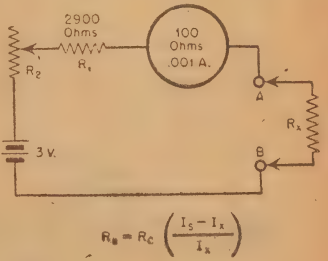
When the unknown resistance is equal to the internal resistance of the ohmmeter circuit, the meter will read half-scale. The formula used for the calibration of this simple ohmmeter type is also shown in Fig. 5. For the measurement of extremely low or high value of resistance, more complex ohmmeter circuits are employed.

## METER ACCURACY

Direct current meters are supplied in many degrees of accuracy according to the requirements of the application. Such applications vary extremely from meters for use as primary laboratory standards having rated accuracies of .1 of 1 per cent to mere indicators of the presence or absence of electricity.

Meters rated at better than 1 per cent accuracy fall into the "precision laboratory" category and should be used only in protected, "well behaved" circuits *requiring* such high accuracy. They are usually of the "portable" type which are used with the needle in a horizontal position for greater accuracy and have mirror-scales to reduce *parallax* errors in reading.

In the accuracy range below 1 per cent are the great majority of "general utility" or "panel" meters which are the "work horses" of the electrical instrument family. They are usually mounted in test equip-




$$R_x = R_c \left( \frac{I_s - I_x}{I_x} \right)$$

Where:

$R_x$ = Unknown resistance.
$R_c$ = Circuit resistance (A and B shorted).
$I_s$ = Meter current (A and B shorted).
$I_x$ = Meter current ($R_x$ in circuit).

TYPICAL OHMMETER CIRCUIT

FIG. 5

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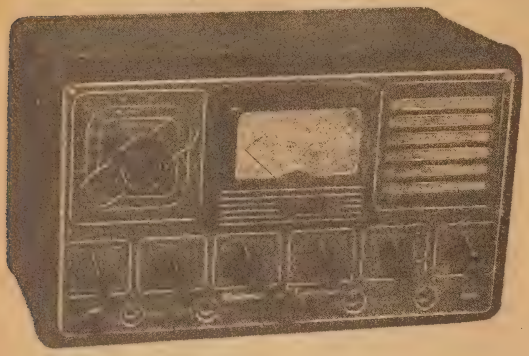
## SIGNAL TRACING & SET ANALYSIS



*With the most up-to-date and Versatile Instrument*

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## SUPERTRACER MODEL AST

This is the most modern, up-to-date, and efficient service instrument that anyone could desire. It is easy to use and gives rapid and accurate location of faults in radio receivers and similar equipment. It speeds up testing, servicing, and production, and will rapidly detect faults which render a receiver inoperative, or which make it intermittent or lacking in sensitivity, or which cause oscillation, distortion, or hum.

The instrument comprises a two-stage tuned R.F. amplifier, a diode detector, and two-stage A.F. amplifier, and, of course, a loudspeaker and power supply. In addition, a vacuum tube voltmeter measuring up to 500 volts A.C. or D.C. at a resistance of 11 megohms on D.C. and 10 megohms on A.C. is provided. The tuning range of the R.F. circuits is 175 to 490 K.C., 550 to 1550 K.C., 1.5 to 4 megacycles, and 6.3 to 18 megacycles. R.F. sensitivity is such that input voltage of the order of a few millivolts may be detected on all ranges, so that the instrument is suitable for use in any district where alternating power mains are available. A capacity type R.F. multiplier in the input circuits in conjunction with the V.T.V.M. enables stage gain measurements to be made.

**TEST PROBES:** The R.F. test probe is fitted internally with a very small series capacity of a few micro-microfarads, so that it does not produce an appreciative detuning effect when applied to the grid or plate of R.F. or I.F. stages in a receiver. The A.F. test probe is a conventional shielded lead for feeding A.F. into the tracer or A.F. out from the tracer for testing A.F. amplifiers or speakers. The D.C. probe contains a series 1 meg isolating resistor, so that the V.T.V.M. may be used to measure plate bias or A.V.C. voltage under actual operating conditions without disturbing the action of a receiver.

**VACUUM TUBE VOLTMETER:** The V.T.V.M. features a centre zero scale for direct voltage measurement, so that voltages which are either positive or negative with respect to a receiver's chassis are instantly indicated without the necessity of reversing test leads or operating a reversing switch. Zero is at the left for alternating voltage ranges, and operation covers the audio frequency range. Voltage ranges are 0/5, 0/25, 0/100, and 0/500 volts at an input resistance of 11 megohms on D.C. and 10 megohms on A.C. ranges. In conjunction with the amplifying stages of the tracer, the meter will indicate R.F. or A.F. voltages down to a value of less than 1 millivolt. Indications are provided by a large, clearly marked rectangular meter with illuminated scale fitted in an attractive modern plastic case measuring 4¾" x 4". The V.T.V.M. and tracer may be used simultaneously for observing signals at two distinct points in a receiver. This feature greatly facilitates location of intermittent faults. Operates from A.C. 220 to 260 volts.

RADIO & ELECTRONIC TEST EQUIPMENT

University

ment panels and switchboards in a vertical position. The average accuracy of this class of meters is about 2 per cent.

The accuracy rating of all d.c. meter types is usually given in terms of the percentage of full-scale reading to which the meter is guaranteed. A single range meter reading 100 volts full scale and rated at 1 per cent accuracy would thus read within 1 volt of the correct value at any deflection. At 10 volts this meter could, therefore, be in error by as much as 1 volt, or 10 per cent. Good engineering practice dictates that meters be used at a minimum of one-third full-scale deflection for this and other reasons.

## POINTS TO WATCH

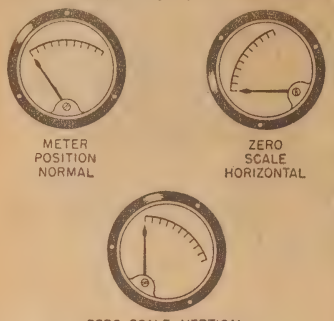
The manufacturer's nominal accuracy rating does not insure accurate results from a meter in the hands of an inexperienced technician or an instrument which has been subjected to abuse. The following tabulates some of the mechanical and operational factors which may cause large errors in the reading of d.c. meters of the d-Arsonval type:

(a) Stray Magnetic Field Errors. Since the deflection of the meter depends on the strength of the permanent magnet, serious errors may be introduced by stray magnetic fields from other meters, current carrying conductors, magnets and other ferrous materials. Expensive meters are usually provided with adequate magnetic shielding. Some errors are also caused by mounting small meters in heavy steel panels. Meters especially calibrated for such mounting are usually so marked.

(b) Balance Errors. The delicate system of counterweights which balance the moving-coil assembly may cause "zeroing" or reading errors if improperly adjusted. The balance of the movement may be checked by holding the meter in the three positions shown in Fig. 6. If the pointer does not indicate zero in each position, the movement is not perfectly balanced. Unbalance is most serious in vertical mounted meters.

(c) Overload Errors. Permanent damage or burn-out may be caused by repeated or heavy overloads of the meter movement. Excessive current through moving-coil types causes heating of the coil and springs. Heating of the latter results in "annealing" or loss of spring tension which impairs accuracy. Overloads also cause "needle banging" which may damage pointer or pivots.

(d) Sticky Movement Errors. The meter movement may be prevented from moving freely by several mechanical defects. Chief among these is chipped jewels or damaged pivots due to rough handling. Sticking may be manifest in the failure of the meter to reproduce a known reading when approached from values above and below the known value. Light tapping of the meter case is frequently resorted to as a cure. Meter sticking is also caused by small magnetic particles which may be gathered by the magnet of a meter which is removed from its case and left unprotected.




TEST FOR MOVEMENT BALANCE

FIG. 6

## OPTAR— A New System of Optical Ranging

(Continued from Page 17).

the interplay of frequencies heard in the earphone.

Not the least impressive feature of the device is the extreme economy of operation. It is powered by a single flashlight cell, operating with a current drain of 60 milliamps. This operates the motor and also supplies the primary impulses for an interrupter circuit producing 1000 volts from a transformer and a selenium type voltage multiplier-rectifier.

The drum speed is given as 2.5 rev per sec, and the eight comb sectors each representing 45 degrees, produces 0.2 milliwatt at spot frequencies between 600 to 2000 c/s.

The device will operate for 100 hours from one cell and simply pressing a button puts it into operation. ("Electronics").

## THE ELEMENTS OF BOOKKEEPING

(Continued from Page 39)

As time goes on you can see how valuable your ledger will become to you. It will not only tell you what your sales are for the year to date, but what they were last month, the same month last year, or the whole of last year.

Should you have an opportunity of purchasing a consignment of stock at a special price, you turn up your purchases account and can see at once whether such a purchase represents two, three or six months normal purchases. In this way you can get the advantage of special offers and also prevent over-stocking.

In a later article I propose to deal with "The Handling of Credit Accounts" and to show you how to keep a record of credit purchases and sales on credit. The records are quite simple and the same ledger that you have been shown in this article will be used.

This view illustrates the general attractiveness of the finished unit. Although the inclusion of an ammeter to show the charge rate is an extravagance we can't justify, there is room for it on the front panel. Note the use of the silvered switch key.

# R & H BATTERY CHARGER

**Here's a project which many readers have been waiting for — a battery charger designed especially for use around the service bench, the garage and the home workshop. It will charge accumulators ranging from 2 to 12 volts at the useful rate of 3 amperes. It is simple to construct and draws a minimum of current from the power mains.**

MANY years ago, when accumulators and eliminators were the order of the day, battery chargers were popular items. They could be bought in a variety of shapes and sizes and there were plenty of parts available for those who wanted to build their own.

The advent of a.c. type tubes changed all that, and to such an extent that it became difficult to get together enough parts to build even a simple charger for the car battery. This is of some consequence, in these days of rising prices, for the useful life of an accumulator depends very largely upon the maintenance given to it.

## CARS AND CYCLES

In the case of cars and motorcycles, the engine-driven generators should keep the battery charged but it doesn't always work out this way if there are lengthy periods of inactivity or night parking. Apart from the inconvenience of a flat battery, its life is likely to suffer if left in this condition.

This is one instance where our new battery charger can come into the picture. It is portable, it operates from the a.c. mains, it can deliver a worthwhile charge rate of

**KIT No. 5**

3 amperes and what's more, it can cope with any size of accumulator from the single 2-volt cell up to the 12-volt size.

In the design of a unit like this, the electrolytic type of rectifier can be ruled out as a "messy" arrangement. A high current valve type rectifier can be set aside because of the heavy filament drain, leaving the metal rectifier as a logical choice. These are reasonably compact and require no other consideration other than adequate ventilation.

Three types of metal rectifier can be used, namely the half-wave, the full-wave and the bridge type. Many versions of these types have appeared in the shops, a goodly proportion being ex-disposals. Readers have used them for a variety of purposes but, in each case, it has been necessary to use a transformer which suited the type of rectifier, bearing in mind the required output volts and the output current.

Unfortunately, the varied types and sizes of such rectifiers are too diverse to permit one design to cope with all of them. Accordingly, we made a survey of the catalogue types and, after considering many angles, we chose the bridge type LT53 as one which is not too expensive and one which, as a standard type, will be available for a long time to come. This rectifier, when coupled to a tapped transformer, produces a versatile charging unit capable of delivering a useful rate of charge current.

Although this rectifier is now a standard item, it is at present in the "just available" category and in some cases there may be a little delay before it will be procurable in all States. This also applies to the transformer and supplies will increase just as soon as the distributors get the stock position organised.

by Raymond Howe

You will note that the tappings on the transformer take into account the variation of the internal impedance of the rectifier with applied voltage. The design figures are worth repeating. For one 2-volt cell, the RMS voltage of the transformer should be 8.5 volts, for two 2-volt cells the RMS voltage should be 10 volts, for three 2-volt cells the RMS voltage required is 11.5 volts and for six 2-volt cells the RMS voltage required is 17 volts. These RMS figures are for the open-circuit voltages at the tappings of the transformer when used with the LT53 bridge type rectifier. The transformer should be rated at a secondary RMS current of 1.4 times the d.c. mean current.

## RESISTOR WATTAGE

The other component associated with these two major items is the ballast resistor. The 1 ohm resistor, in conjunction with the effective resistance of the transformer, provides the right amount of "ballast." This resistor will obviously carry the same amount of RMS current as the trans-

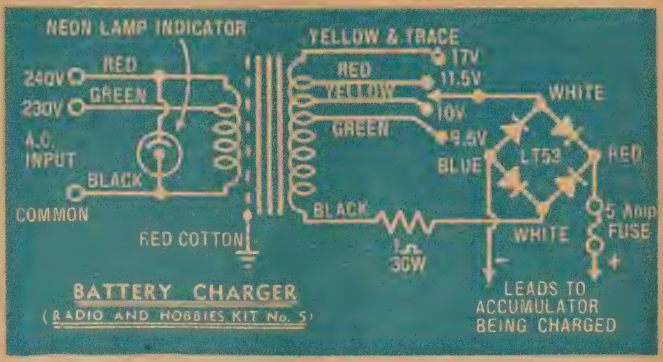
former secondary winding, which is 1.4 times the mean d-c current of 3 amperes.

Simple Ohms Law calculation indicates that something like 17 odd watts will be dissipated in this resistor when the full charge current flows. The 30 watt size is the largest available but nevertheless is satisfactory for the purpose.

Considering the circuit diagram as a whole, you will see that a neon indicator is connected across the incoming mains leads which attach to the primary winding of the transformer. This winding is tapped for 230 and 240 volts to take in any variations in the mains supply in different localities.

The tapped secondary winding has already been covered. These tappings are taken to a selector switch which is adjustable to suit the size of battery to be charged. In view of the current drain, we discarded the idea of using a non-shorting rotary switch, even though the paralleling of contacts would increase their current carrying capacity.

## CIRCUIT OF BATTERY CHARGER




The simplicity of the circuitry is evident from this schematic diagram. The color-coding on the transformer leads is for the Ferguson PF265. Color-coding of other brands will be supplied with the transformer. Using a standard 15 watt pilot lamp in place of the neon indicator will result in additional heat being generated within the case.

## CONNECTIONS

Instead, we adopted the simple arrangement using five 3-16th inch brass bolts and a strip of brass slotted to enable it to be slipped under the washers at any of the four range positions merely by loosening the nuts a turn or so. The result is a cheap and yet effective switch.

The connections to the rectifier are clearly marked both on the circuit diagram and the rectifier itself. You should have no difficulty there. The outgoing leads to the battery are taken from the rectifier lugs marked with red and blue, the red being the positive lead and the blue the negative lead. A 5 amp fuse holder is wired in series with one of these leads. Although we have shown it as being in the positive lead, it does not matter in which lead the fuse is wired.

The front panel and attached tray-type chassis carry all of the components and wiring. The front panel is made up from 3-16th inch bakelite. A metal panel would have been cheaper but the general scarcity of self-locating insulating washers for the selector switch bolts swung the choice in favor of bakelite. Naturally, the front panel, the chassis and the neon indicator mounting bracket will be part of the kit for this unit. Incidentally, we have grouped the items on the front panel to enable a meter to be fitted if your ideas run in that direction.

## HOUSING

The complete unit is housed in what we have previously adopted as our standard instrument case. Such standardisation lends for more ready availability of these items. The case is modified slightly in the way of further ventilation holes. In this respect we added two rows of ¼-inch diameter holes along the back of the case, one row being about 1 3-8 inches from the bottom edge and the other being the same distance from the top edge. In addition to these, four ¼ inch diameter holes were drilled in the bottom of the case directly below the cooling fins of the rectifier, with another four ¼ inch diameter holes directly below the ballast resistor.

The standard case has four indentations pressed into the bottom to act as mounting feet. If your case does not happen to have these, attach four rubber feet, otherwise the ventilation will be impaired. Standing the case on a couple of wooden slats will further improve ventilation under the case.

## COLOR CODE

Coming to the actual constructional side, you will agree that there is really very little to be done. The inside photographs indicate clearly where everything goes. In mounting the transformer, straighten the leads and pass them through the two holes provided for them in the chassis and into each of which a grommet has been pressed. We used 3-16th inch bolts to hold the transformer although 1-8 inch size could be used if washers are placed under the head.

Sort the transformer leads out according to the color code supplied and lay them into place. Commencing with say, the heavy gauge secondary leads, trim them to a suitable length one by one and remove the outer spaghetti covering and the enamel coating on the wire to a distance of about ¾ inch. You will notice that there are two wires for each tapping, one coming out from the winding and the other returning. Bare both wires and twist the bared portions together so that they make good contact. It is a good plan to tin and solder them after being twisted together.

Place the bared portion between two washers under the head of the appropriate bolt in the selector switch, bending the wire around in a clockwise direction to avoid being ejected by the turning of the bolt head. See that the wire under one bolt head does not short to an adjacent bolt.

## SWITCH BOLTS

Each bolt in the selector switch carries five 3/16th washers and two nuts, two of the washers being under the head at the back of the panel, the third between the first nut and the outside of the panel, the remaining two being between the two nuts.

The leads from the primary winding of the transformer are soldered to a 6-tag mounting strip to which

## PARTS LIST

- 1 Standard instrument case 9⅛" x 6⅜" x 5½"
- 1 Front panel, 3/16th inch bakelite, 9⅛" x 6⅜"
- 1 Panel-mounting chassis, 7¼" x 5¼" x 1" with 5" side brackets.
- 1 Power transformer, tapped primary for 230 and 240 volts, tapped secondary rated to carry 4.2A with off-load voltage tappings of 8.5v, 10v, 11.5v, 17v. (Ferguson PF265 or similar).
- 1 12v, 3A bridge type metal rectifier, LT53.
- 1 1 ohm 30 watt wirewound resistor.
- 1 5A fuseholder, (Slydlok or similar).
- 1 Cordgrip BC adaptor.
- 1 250v, ½W neon indicator lamp.
- 1 6-tag mounting strip, 3 rubber grommets, ¼" inside dia.
- 5 ¾" by 3/16th dia. brass bolts with 10 hexagon brass nuts and 25 brass washers.
- 1½ doz. ⅜" by ⅛" brass bolts with nuts.
- 1 Piece scrap brass 2½" by 7/16th in. for selector switch.
- 1 Piece scrap metal 6⅜" by 1½" for neon indicator bracket.
- 2 25 amp. battery clips, 1 3-pin flat plug.
- 3 yds. (approx.) 3-core rubber-covered power cable (approx. 40/36).

also connects the incoming a-c mains leads and the wiring to the neon indicator lamp. Bend the lugs on the tag strip at right angles to give added clearance from the case bottom.

The fine multistrand red-cotton covered lead from the transformer is the internal shield and should connect to the chassis. The logical point is the tag of the 6-tag strip which bolts to the chassis under the same bolt which holds the rectifier.

Three-core rubber-covered cable is used for the a-c mains lead with the green wire connecting to the chassis. At the other end fit the conventional 3-pin flat plug so that the green wire connects to the "earth" pin.

## BATTERY CABLE

The same type of cable is used for the leads to the battery. The black and green wires are connected together and called the negative lead. The remaining red lead is used for the positive merely to retain the somewhat standard color-coding for polarity. The 25 amp. size of battery clips are fitted to the free end of this cable. After stripping the rubber covering for a distance of about 9 inches, cut, say, the red wire a few inches shorter so that with the battery clips attached and the cable hanging free, the clips do not short together.

Both the battery cable and the a-c mains cable are clamped to the chassis at convenient points so that any unintentional strain or pull is not transmitted to the connections.

For those wiring runs between the ballast resistor and rectifier, the fuse-holder and rectifier and the selector switch and rectifier, use electrical wiring cable or the leads from a scrap length of the power cable. Five ampere fuse wire is readily available on the usual "household" card or, as an alternative, you could use one strand from the 40/36 wire in the power cable.

Well, that's all there is to it. It is quite straightforward with no headaches and represents but a few hours' effort.

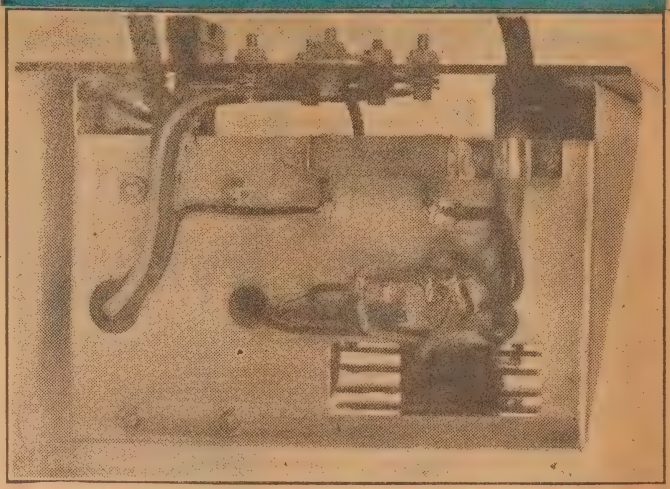
When using the charger, always make sure that the battery clips are attached to the appropriate terminals of the accumulator, otherwise the accumulator will be damaged. The positive lead of the charger should connect to the accumulator terminal marked positive and so on.

## SPECIFIC GRAVITY

When the charger is switched off, it is a good plan to remove one of the clips from the accumulator. Although the "back" current is very small—of the order of a milliampere or so—the precaution is worth taking.

The condition of charge of an accumulator is best determined by measuring the specific gravity of the electrolyte with a hydrometer, although the terminal voltage reading will give some indication, provided that the accumulator is under a nominal load.

## TWO VIEWS OF CHARGER UNIT

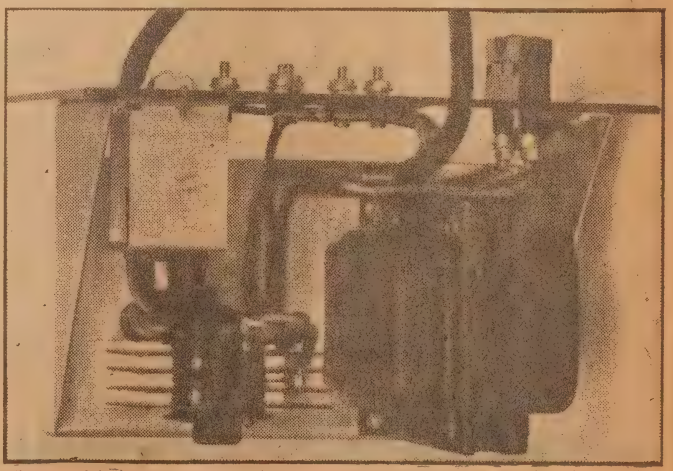


This underneath view shows the transformer wiring and the location of the ballast resistor. The standard 30 watt 1 ohm resistor is 1 inch longer than the one shown in the photograph. Note the holding clamp for the incoming power cable. The tag mounting strip is held under the bolt securing the rectifier.

There should, however, be some relationship between the specific gravity and the terminal voltage. A fully charged accumulator will reach a terminal voltage of 2.5 to 2.7 volts per cell (about 2.3 volts for an old battery), although this figure will drop to 2.2 volts or slightly less immediately the charging current is removed. The specific gravity of a fully charged accumulator will be in the vicinity of 1.270. This figure will be modified by the climatic temperature, being higher for cold climates and lower for hot climates.

If when the accumulator is fully charged there is wide discrepancy between the actual specific gravity of the electrolyte and the normal figure, it could be an indication that strong electrolyte has been added at some time or that a large quantity of spilled electrolyte has been replaced with distilled water. Whatever the cause, it is necessary that the specific gravity of the electrolyte be adjusted.

Whichever way you go about obtaining or producing the electrolyte always remember the very important point that water should never be added to acid in the mixing process. Always add acid to water.



The actual location of most of the components can be seen from this photograph. The clamp for the outgoing battery cable is held under one of the transformer mounting bolts. Note the make-up of the tray-type chassis and the ventilation cut-out underneath the rectifier.

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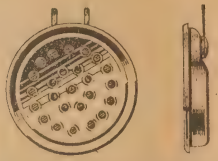

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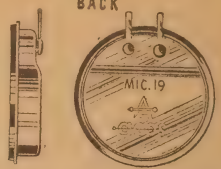


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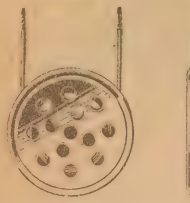

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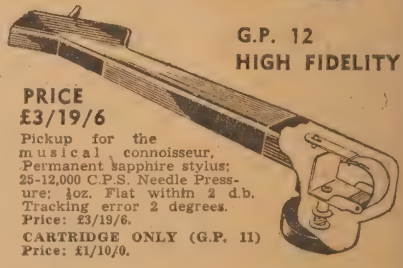

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SOLE AUSTRALIAN REPRESENTATIVES

# A COURSE IN TELEVISION

**All modern television systems use a composite signal containing not only the picture information but the synchronising pulses necessary to hold the sweep oscillators at the receiving end in step with those at the transmitter. This article suggests typical methods by which the synchronising pulses are extracted from the signal.**

## PART 18—SYNCH. SEPARATION CIRCUITS

THE need for synchronising pulses is self-evident. It is impossible to build simple oscillators which do not show some tendency to frequency drift and this applies to those which control the vertical and horizontal spot movement across the television screen.

The technique, therefore, is to design the sweep oscillators to operate at approximately the correct frequency, then apply master pulses from the transmitter to trigger off each separate cycle of operation. This takes care not only of variations from one receiver to the next, but also of the smaller but inevitable variations in the transmitter sweep circuits.

It will be recalled that the exact nature of the pulses in relation to the carrier depends on whether positive or negative modulation is used.

In the case of positive modulation, the black level corresponds to about 30 per cent of the peak carrier amplitude and the synchronising pulses cut a rectangular slice into the remaining carrier down to near-zero modulation percentage.

### SYNCH. PULSES

With negative modulation, the picture signal peaks up to about 75 per cent of the maximum carrier amplitude, the synchronising pulses rising in sharp rectangular wedges to the nominal 100 per cent value.

We need not concern ourselves here with the exact amplitude, duration or repetition rate of the pulses. The significant point in each case is that the synchronising pulses extend into the infra-black region, where they cannot effect the picture on the tube screen. In terms of carrier amplitude, they extend into a region not occupied by the picture signals and all synch. separation circuits are, therefore, designed to take advantage of this amplitude difference.

For the sake of simplicity, it is easier to extract the pulses at a point where the signal is at a high relative amplitude and it can, theoretically, be done just prior to the detector or at a convenient point along the video amplifier chain. Pre-detector separation, however, requires considerable I.F. gain and a high detector input signal and it is therefore most attractive in designs which feed the detector output direct to the picture tube.

Figure 1 illustrates the principles of one circuit of this type, designed for use on the British positive modulation system.

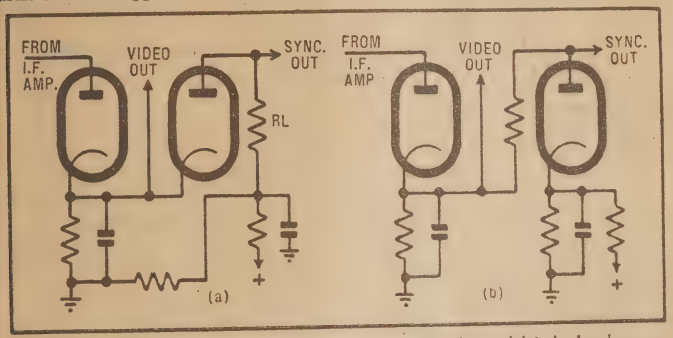


Figure 1. A pentode synch. separator for positively modulated signals.

The signal voltage from the last I.F. transformer, which needs to have a peak value of about 15, is fed through separate coupling networks to the detector and to the synch. separation tube.

This latter is a pentode whose operating conditions have been arranged deliberately to restrict the amplitude of signals it can handle and to show a very sharp "knee" at both the top and bottom bend.

The network of resistors is arranged to provide a moderate screen voltage but a very low value of plate voltage, typical figures being 50 and 10 respectively. A bleed current through the cathode resistor holds the bias steady at a value which approximates or slightly exceeds plate current cut-off for the tube under the particular operating conditions.

### LIMITING EFFECT

When the grid receives an input signal, the plate current rises rapidly to follow the wave front but, at a value of 3 or 4 volts, the plate current reaches its saturation value above which it cannot substantially increase. The effect is therefore to square off all modulation exceeding a peak value of 3 or 4 volts.

As already mentioned, the peak value may originally have been 15 odd volts and, assuming positive modulation, most of the modulation thus "squared off" corresponds to the picture intelligence. In other words, all that the tube succeeds in passing is essentially the synch. pulses representing the first 30 per cent of peak carrier modulation.

By shifting the bias so that the fixed value corresponds with the

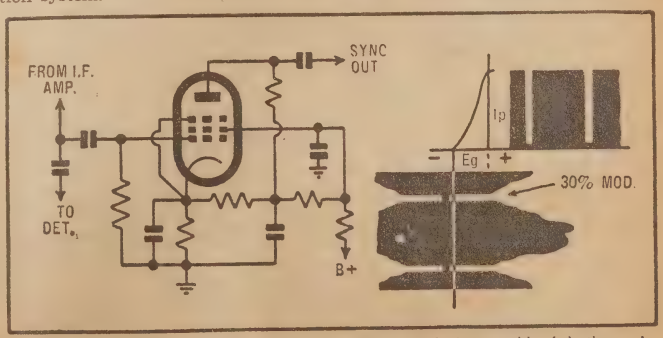


Figure 2. Diode separators for positive modulation which resemble (a) the series and (b) the shunt diode limiter seen in A.M. communication receivers.

# STANDARD -FERGUSON- RANGE

## POWER & VIBRATOR TRANSFORMERS

| | A.C. | Vib. | | | Retail |
|---|---|---|---|---|---|
| PF 122 | 240 | 6 | 220 | 40 | 6.3V @ 2A | 33/6 |
| PF 125 | 240 | 6 | 250 | 60 | 6.3V @ 2A | 43/- |
| PF 119 | 240 | 6 | 325 | 125 | 6.3V @ 4A | 62/- |
| PF 182 | 240 | 12 | 200 | 40 | 12.6V CT @ 1A | 33/6 |
| PF 126 | 240 | 12 | 250 | 60 | 12.6V CT @ 1A | 47/6 |
| PF 146 | 200,30,40 | 12 | 325 | 150 | 12.6V CT @ 2.5A | 67/- |

## FILTER CHOKES

| | Induct | D.C. Res. | M.A. | Retail |
|---|---|---|---|---|
| CF 100 | 50 | 1900 | 10 | 18/- |
| CF 101 | 30 | 870 | 25 | 18/- |
| CF 102 | 15 | 300 | 60 | 12/- |
| CF 103 | 30 | 420 | 60 | 26/- |
| CF 104 | 30 | 580 | 75 | 31/- |
| CF 105 | 15 | 250 | 80 | 24/- |
| CF 106 | 12 | 200 | 100 | 24/8 |
| CF 107 | 30 | 360 | 100 | 34/8 |
| CF 108 | 12 | 135 | 150 | 35/- |
| CF 109 | 20 | 225 | 150 | 37/8 |
| CF 110 | 12 | 100 | 200 | 43/8 |
| CF 111 | 16 | 165 | 200 | 45/10 |
| CF 112 | 10 | 70 | 250 | 46/2 |

## SPECIAL CHOKES

| | | | | | Retail |
|---|---|---|---|---|---|
| CF 113 | .5 | 70 | 250 | | |
| | 20 | | 50 | Swinging choke | 50/6 |
| CF 114 | 1.1 | 23 | 375 | Ballast choke | 24/- |
| CF 115 | .017 | .6 | 2 amps | L.T. choke | 10/- |

## OUTPUT TRANSFORMER TO VOICE COIL
### Full Frequency Range (30-15000)

| Code No. | Pri. | Imped. | Sec. | Imped. | Watts | Retail |
|---|---|---|---|---|---|---|
| OP24 | 5000 | SE | 8.4, 2.1, with feed back | | 5 | 44/10 |
| OP23 | 3250 | SE | 12.5, 8.4, 2.1 | | 10 | 65/1 |
| OP19A | 5000 | PP | 12.5, 8.4, 2.3 | | 15 | 102/10 |
| OP51 | 4500 | PP | 15.5, 12.5, 8.6, 2.7, 2 | | 20 | 90/- |
| OP63 | 10000 | PP | 15, 3.75 | | 15 | 100/- |
| OP64 | 10000 | PP | 12.5, 3.125 | | 15 | 100/- |
| OP65 | 10000 | PP | 8.4, 2.1 | | 15 | 100/- |

## OUTPUT TRANSFORMER TO VOICE COIL
### Special Full Frequency (20-30,000)

| | | | | | | Retail |
|---|---|---|---|---|---|---|
| OP25/40 | 10000 | PP | 40, 10 | | 15 | 130/- |
| OP25/16 | 10000 | PP | 16, 4 | | 15 | 130/- |
| OP25/15 | 10000 | PP | 15, 3.75 | | 15 | 130/- |
| OP25/12 | 10000 | PP | 12, 3 | | 15 | 130/- |
| OP25/10 | 10000 | PP | 10, 2.5 | | 15 | 130/- |
| OP25/8.4 | 10000 | PP | 8.4, 2.1 | | 15 | 130/- |
| OP66 | 5000 | PP | 8.4, 3.7 | | 15 | 130/- |
| OP67 | 5000 | PP | 15, 6.5 | | 15 | 130/- |

## OUTPUT TRANSFORMER TO LINE—
### Full Freq. Range.

| | | | | | | Retail |
|---|---|---|---|---|---|---|
| OP22 | 3250 | SE | 500, 125, 8.3 | | 10 | 65/1 |
| OP19b | 5000 | PP | 500, 250, 125 | | 15 | 102/10 |
| OP21 | 8000 | PP | 500, 250, 125 | | 15 | 82/10 |
| OP62 | 10000 | PP | 500, 125 | | 15 | 100/- |

## OUTPUT TRANSFORMER TO LINE—
### Special Full Freq. Range

| | | | | | | Retail |
|---|---|---|---|---|---|---|
| OP25/500 | 10000 | PP | 500, 125 | | 15 | 130/- |
| OP25/250 | 10000 | PP | 250, 62.5 | | 15 | 130/- |

## VIBRATOR TRANSFORMERS

| Code No. | Prt. V. | D.C. Out. | MA | Buffer Full Sec. | | Retail |
|---|---|---|---|---|---|---|
| VT 100 | 32 | 200 | 40 | .005 | Sync. | 27/- |
| VT 101 | 6 | 90 | 15 | .008 | " | 19/6 |
| VT 102 | 6 | 150 | 25 | .005 | " | 23/10 |
| VT 103 | 6 | 200 | 50 | .005 | " | 25/- |
| VT 104 | 6 | 250 | 60 | .005 | " | 37/- |
| VT 105 | 12 | 250 | 60 | .005 | " | 37/- |
| VT 106 | 6 | 300 | 75 | .008 | " | 52/- |
| VT 107 | 6 | 250 | 60 | .005 | Sync. Low Rad. | 30/6 |
| VT 108 | 12 | 90 | 15 | .008 | Sync. | 21/8 |
| VT 109 | 24 | 90 | 15 | .008 | " | 23/8 |
| VT 110 | 12 | 150 | 25 | .005 | " | 23/10 |
| VT 111 | 24 | 150 | 25 | .005 | " | 26/6 |
| VT 112 | 12 | 200 | 50 | .005 | " | 25/- |
| VT 113 | 24 | 200 | 50 | .005 | " | 26/6 |
| VT 114 | 12 | 200 | 75 | .008 | " | 54/2 |
| VT 115 | 24 | 300 | 75 | .008 | " | 55/6 |
| VT 116 | 24 | 250 | 60 | .005 | " | 30/- |
| VT 117 | 12 | 250 | 60 | .005 | Non Sync. Low Rad. | 31/- |
| VT 119 | 32 | 150 | 25 | .005 | Sync. | 25/6 |
| VT 121 | 6 | 180 | 30 | .005 | " | 25/4 |
| VT 122 | 6 | 400 | 50 | .005 | " | 50/- |
| VT 123 | 12 | 320 | 125 | .005 | Sync. | 63/3 |
| VT 124 | 32 | 250 | 60 | .005 | " | 30/- |
| VT 127 | 6 | 200 | 50 | .005 | Sync. Low Rad. | 29/8 |
| VT 128 | 12 | 250 | 60 | .005 | Sync. Low Rad. | 38/- |

## RECEIVER POWER TRANSFORMERS

| Code No. | Prim. | HTV Aside | HTV | M.A. | Filaments | Retail |
|---|---|---|---|---|---|---|
| PF 185 | | 240 | 150 | 30 | 6.3V @ 2A | 24/- |
| PF 106 | | 240 | 325 | 45 | 6.3V @ 2A, 5V @ 2A | 30/- |
| PF 198 | | 240 | 285 | 50 | 6.3V @ 2A, 5V @ 2A | 30/- |
| PF 151 | 200,30,40 | 285 | | 60 | 6.3V @ 2A, 5V @ 2A | 34/- |
| PF 165 | 200,30,40 | 385 | | 60 | 6.3V @ 2A, 5V @ 2A | 34/- |
| PF 170 | 200,30,40 | 285 | | 80 | 6.3V @ 2A, 6.3V @ 2A, 5V @ 2A | 39/10 |
| PF 168 | 200,30,40 | 385 | | 80 | 6.3V @ 2A, 6.3V @ 2A, 5V @ 2A | 39/10 |
| PF 130 | 200,30,40 | 285 | | 100 | 6.3CT @ 2A, 6.3V @ 2A, 5V @ 2A | 46/- |
| PF 160 | 200,20,40 | 385 | | 100 | 6.3CT @ 2.5A, 6.3V @ 2A, 5V @ 2A | 46/- |
| PF 152 | 200,30,40 | 285 | | 125 | 6.3CT @ 3A, 6.3V @ 2A, 5V @ 2A | 56/- |
| PF 181 | 200,30,40 | 385 | | 125 | 6.3CT @ 3A, 6.3V @ 3A, 5V @ 2A | 66/- |
| PF 174 | 200,30,40 | 285 | | 150 | 6.3CT @ 2A, 6.3V @ 2A, 5V @ 2A | 60/- |
| PF 175 | 200,30,40 | 385 | | 150 | 6.3CT @ 2A, 6.3V @ 2A, 5V @ 3A | 70/- |
| PF 173 | 200,30,40 | 425 | | 175 | 6.3CT @ 3A, 6.3V @ 2A, 5V @ 3A | 110/- |
| PF 140 | 200,30,40 | 385 | | 200 | 6.3CT @ 3A, 6.3V @ 3A, 5V @ 3A | 111/- |
| PF 171 | 200,30,40 | 385 | | 250 | 6.3CT @ 4A, 6.3 @ 3A. 5V @ 3A | 144/- |
| PF 201 | | 240 | 225 | 50 | 6.3 @ 2A | 29/11 |

## LINE TO VOICE COIL TRANSFORMERS

| | Pri. | Imped. | Sec. | Imped. | Watts | Retail |
|---|---|---|---|---|---|---|
| MT111 | 500 | | 12.5, 8, 2.3 | | 10 | 36/9 |
| MT100 | 600 | | 4, 3 | | 15 | 36/9 |
| MT101 | 500 | | 15 | | 15 | 36/9 |
| MT124 | 600, 500 | | 4, 3, 2.7, 2.3, 2 | | 25 | 66/- |
| MT125 | 600, 500 | | 15, 12.5, 8.4, 6.5 | | 25 | 66/- |

## MODULATION TRANSFORMERS

| | | | | Retail |
|---|---|---|---|---|
| MT118 | 8000, 6000 PP | 10000, 7000 5000 | 25 | 85/- |
| MT119 | 8000, 6600, 3800 PP | 10000, 7500, 6500 5500, 4500, 3500 | 50 | 111/- |
| MT120 | 500 to 20000 in steps. | 500 to 30000 in steps. | 50 | 200/- |
| MT121 | 500 to 20000 in steps. | 500 to 30000 in steps. | 125 | 276/- |

## Output Transformer To Voice Coil—P.A. Range

| | Pri. | Imped. | Sec. | Imped. | Watts | Retail |
|---|---|---|---|---|---|---|
| OP1 | 5000, 2500 | SE | 12.5, 8, 2.3 | | 10 | 39/10 |
| OP54 | 5000, 2500 | SE | 15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2 | | 10 | 45/8 |
| OP39 | 5000, 2500 | SE | 15 | | 10 | 39/10 |
| OP33 | 5000, 2500 | SE | 5, 2.7 | | 10 | 39/10 |
| OP41 | 5500 | SE | 3.7 | | 10 | 46/- |
| OP53 | 30000, 20000 14000, 10000, 7000 5000, 2500 | PP | 2.3 | | 10 | 36/9 |
| OP2 | 5000 | PP | 12.5, 8, 2.3 | | 15 | 65/1 |
| OP55 | 5000 | PP | 15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2 | | 15 | 73/10 |
| OP3 | 6600 | PP | 12.5, 8, 2.3 | | 15 | 65/1 |
| OP56 | 6600 | PP | 15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2 | | 15 | 73/10 |
| OP4 | 10000 | PP | 12.5, 8, 2.3 | | 15 | 65/1 |
| OP57 | 10000 | PP | 15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2 | | 15 | 73/10 |
| OP5 | 10000, 6600, 5000 | PP | 12.5, 8, 2.3 | | 15 | 65/1 |
| OP58 | 10000, 6600, 5000 | PP | 15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2 | | 15 | 76/2 |
| OP59 | 10000, 6600, 5000 | PP | 15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2 | | 25 | 93/8 |
| OP60 | 10000, 6600, 5000 | PP | 15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2 | | 32 | 116/8 |

## OUTPUT TRANSFORMER TO LINE—P.A. Range

| | Pri. | Imped. | Sec. | Imped. | Watts | Retail |
|---|---|---|---|---|---|---|
| OP1A | 5000, 2500 | SE | 500 | | 10 | 39/10 |
| OP44 | 5000, 2500 | SE | 500, 250, 125 | | 10 | 47/- |
| OP34 | 5000 | PP | 600, 300, 200, 150, 130, 100 75, 50 | | 15 | 81/4 |
| OP6 | 5000 | PP | 500, 250, 125 | | 15 | 65/1 |
| OP7 | 6600 | PP | 500, 250, 125 | | 15 | 65/1 |
| OP50 | 8000 | PP | 600, 300, 120, 60, 30 | | 15 | 126/- |
| OP8 | 10000 | PP | 500, 250, 125 | | 15 | 65/1 |
| OP8M | 10000 | PP | 500, 250, 160, 125, 100, 83.5 71.5, 62.5, 55.5, 50 | | 15 | 71/3 |
| OP9 | 10000, 6600, 5000 | PP | 500, 250, 125 | | 15 | 65/1 |
| OP10 | 5000 | PP | 500, 250, 125 | | 25 | 81/10 |
| OP11 | 6600 | PP | 500, 250, 125 | | 25 | 81/10 |
| OP38 | 6600 | PP | 600, 300, 250, 200, 170, 150, 76, 50, 36, 27, 12.5, 7.5, 3.6, 2.7 | | 25 | 140/- |
| OP12 | 10000 | PP | 500, 250, 125 | | 25 | 81/10 |
| OP13 | 10000, 6600, 5000 | PP | 500, 250, 125 | | 25 | 81/10 |
| OP35 | 10000, 6600 | PP | 500, 4000, 8.4, 2.2 | | 25 | 120/- |
| OP14 | 5000 | PP | 500, 250, 125. | | 32 | 102/10 |
| OP48 | 6600 | PP | 140, 70. | | 32 | 117/8 |
| OP15 | 6600 | PP | 500, 250, 125 | | 32 | 102/10 |
| OP15M | 6600 | PP | 500, 250, 166, 125, 100 83.5, 71.5, 62.5, 55.5, 50 | | 32 | 104/1 |
| OP16 | 10000 | PP | 500, 250, 125 | | 32 | 102/10 |
| OP17 | 10000, 6600, 5000 | PP | 500, 250, 125 | | 32 | 102/10 |
| OP36 | 3800 | PP | 17.6 | | 60 | 108/7 |
| OP18 | 3800 | PP | 500, 250, 125 | | 60 | 108/7 |
| OP61 | 3800 | PP | 100, 75, 25, 10, 5, 2 | | 60 | 133/8 |
| OP37 | 6400 | PP | 500, 250, 125 | | 80 | 150/8 |
| OP49 | 8800, 6000 | PP | 500 | | 105 | 210/- |
| OP20 | 11600, 8400 | PP | 500, 250, 125 | | 150 | 276/- |

ALL PRICES SUBJECT TO ALTERATION WITHOUT NOTICE

top "knee" of the curve, it is possible to produce timing pulses of the opposite phase.

While the circuit is essentially simple and versatile, its operating conditions must be critically adjusted to ensure consistent performance and to produce pulses which do not show an excessive picture signal content.

This same type of circuit can also be supplied with the rectified signal from a diode detector but this calls for an even greater signal from the last I.F. transformer and also sets up an inter-dependence between the polarity of the detector and the synchronising signals.

Diodes are commonly used in separator circuits, having the obvious advantage of simplicity. By applying an initial voltage to the plate or cathode, thus "biasing" the diode, it can be made to conduct over specific portions of the input voltage cycle.

Figure 2 illustrates two possible diode separator arrangements operating in conjunction with the detector and arranged to handle a positively modulated signal.

A "bleed" circuit from the H.T. line in figure 2a maintains the diode plate at small positive potential. The cathode is connected to the detector cathode, which produces positive going signals in the presence of an R.F. input carrier.

## BURSTS OF SIGNAL

The idea is to arrange the circuit such that the two cathodes are more positive than the plate of diode 2 over the whole of the normal picture signal modulation. When the carrier amplitude suddenly drops to zero during timing pulse intervals, the cathode potential drops below plate potential and diode 2 conducts. Thus bursts of signal appear across the load resistor RL corresponding to the synch. pulses.

This type of separator has the known good qualities of a series diode noise limiter, the only complication being that some signal components can appear across RL by reason of the capacitance between the diode elements. To avoid this effect, the separator diode needs to be a high perveance low capacitance type, while RL can have as much shunt capacitance as can be permitted by the operation of the circuit. In other words, the design problem is the same as that which governs the detector diode.

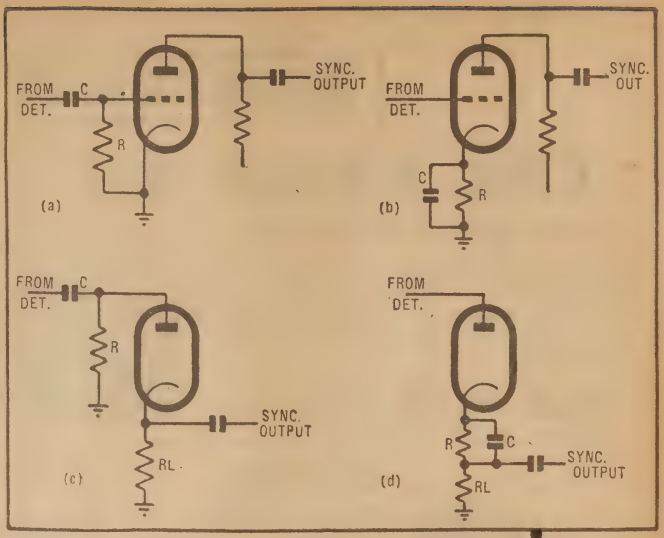


Figure 3. Synch. separator circuits for negatively modulated signals using amplifying valves (a & b) and diodes (c & d).

Figure 2b shows an alternative arrangement in which the separator diode functions after the manner of a parallel noise limiter. In this case, the cathode is biased to a point approximately equal to the peak amplitude of the pulse signals, as produced at the detector cathode.

The pulse wave-front, representing from zero to 30 per cent modulation, is fed to the synch. circuits via R1. Diode 2 does not conduct during this time, because its cathode is more positive than the plate.

The moment the plate tends to go more positive, as during the picture - signal interval, the diode conducts and, by its shunting action across R1, prevents the plate of the synch. separator diode from following the modulation envelope.

Still other arrangements can be used with alternative detectors, as, for example, the anode bend detector which is used in some English receivers. However, the reader will by this have grasped the general approach to the design requirements.

With negative modulation, the synch. pulses form the modulation peaks and, while the separator must still operate on the amplitude difference, its operation is reversed. The requirement is to select and amplify only the peaks of signal, ignoring the modulation content up to 75 odd per cent.

Figure 3 suggests various principles which are adopted to achieve this end. All assume that the output of the detector is positive-going and that it is applied to the synch. separator input.

Figure 3a has the appearance of a grid detector and that essentially is what it is, except that the input signal has already been rectified.

On the succession of positive peaks the grid draws current through R and sets up a charge across C, making the grid initially negative with respect to earth. The time constant of R and C is such that the grid "base" potential remains more or less constant and sufficiently negative to hold the valve to cut-off over the picture signal interval.

## POSITIVE GRID

The grid swings positive and plate current flows only during the brief high amplitude synchronising pulses. Thus, the plate current is ideally cut off during the time when picture intelligence is being transmitted, rising steeply to form a pulse when the grid is carried positive by the high amplitude pulse on the carrier.

Obviously, the time constant of R and C is the key to successful operation of the circuit.

Figure 4b shows a rather similar but alternative arrangement. Here the high initial bias is obtained in

(Continued on Page 95)

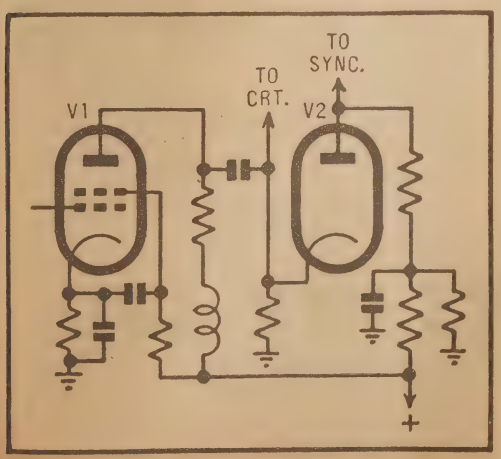


Figure 4. This simple diode and the final video amplifier gives a d-c restoration effect as well as synch. separation.

# ANNOUNCING!

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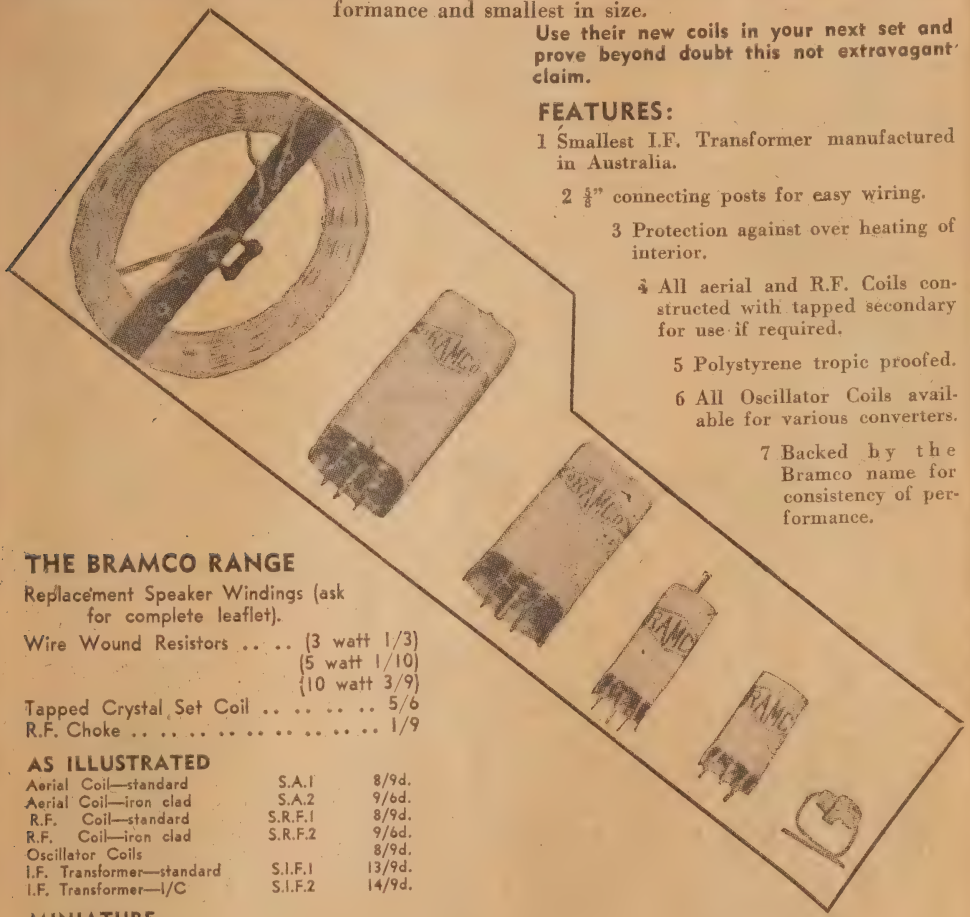

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| Aerial Coil—standard | S.A.1 | 8/9d. |
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| I.F. Transformer—I/C | S.I.F.2 | 14/9d. |

### MINIATURE

| | | |
|---|---|---|
| Midget Loop Aerial LOI | | 7/6d. |
| Midget Aerial Coil I/C | M.A.1 | 8/9d. |
| Midget R.F. Coil I/C | M.R.F.2 | 8/9d. |
| Midget Oscillator Coils | shielded | 8/9d. |
| Midget Oscillator Coils | on resistor | 4/9d. |
| Midget I.F. Transformers | M.I.F.1/2 | 13/9d. |

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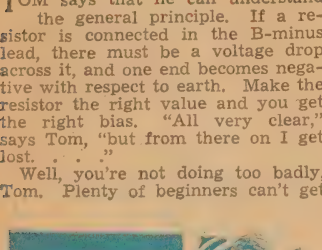
# Here's your answer, Tom!

**Tom is doing his level best to follow the "wheres and the whyfors" of our designs but it's hard going, because we seem to arrive at the most unaccountable conclusions. His immediate difficulty is to understand some of the back-bias arrangements we use.**

TOM says that he can understand the general principle. If a resistor is connected in the B-minus lead, there must be a voltage drop across it, and one end becomes negative with respect to earth. Make the resistor the right value and you get the right bias. "All very clear," says Tom, "but from there on I get lost. . . ."

Well, you're not doing too badly, Tom. Plenty of beginners can't get




that far on their first attempt. But let's take your first question.

**You always seem to allow for a lot less current in your designs than one would expect from valve lists. Are the lists wrong, or are you wrong, or am I barking up the wrong tree?**

Well, Tom, the lists certainly aren't wrong, and we don't think we are. You'll have to draw your own conclusions.

Actually the question is quite an old one, and we have answered in various articles many times before this. But it works out this way:—

The valve lists show that a 6V6 will draw just about 50 milliamps of cathode current under the maximum class A conditions. In so doing, it will deliver some 4½ watts of audio power.

This is more power than most ordinary receivers need to deliver, so designers quite frequently raise the bias by a couple of volts, sacrificing a spot of power output but saving 10 milliamps or so of high-tension current. It makes life easier for both the valve and the rectifier, and therefore offers a possible extension in service life.

In battery sets they often do the same thing to add a few weeks to the life of the batteries.

Then there's the diode/amplifier valve which may be quoted in the lists as having a plate current of several milliamps under certain conditions. But the chances are that, if resistance-coupled, it won't draw more than a half-milliamp, which is a very different story.

The IF amplifier in a superhet may draw from 10 to 15 milliamps "flat out," but the point is that it seldom has to work that way. Most of the time the set is tuned to a strong station, and the action of the AVC cuts the drain back to half the expected figure . . . and this is the one usually taken as a basis for the bias calculation.

So the story goes on from one stage to another; but, in the end, the designer has saved many milliamps, and the whole set may draw only 60 instead of something around 80. In a battery set the reduction may be from 18 or 20 to 10 or 12 in a typical case, which means a lot in terms of battery life.

So there you are, Tom. Even though you may not appreciate the finer points, at least you will understand the process by which the figures are reached.

**The back-bias voltage always seems to be calculated for the output valve. How do you get on about valves which don't require as much bias?**

It's as easy as falling off a log, Tom. Let's say that the output valve requires 15 volts of bias and that another valve somewhere only needs 3 volts. You simply arrange for the resistor to produce 15 volts with the current flowing, then establish a tap one-fifth up from the earthed end, where the voltage could be expected to be 3.

The tapping can be a sliding clip on the main resistor, or you can use two separate resistors which have the correct total value, but in the ratio of one-fifth to four-fifths . . . that is 1:4.

For example, if the total resistance had to be 500 ohms, then it could be made up of two resistors in series, one of 100 ohms and one of 400 ohms. On odd occasions we have used three or even four resistors in a back-bias network to meet the needs of several valves.

A further method is to use large resistors to tap off a proportion of the total bias for individual stages.

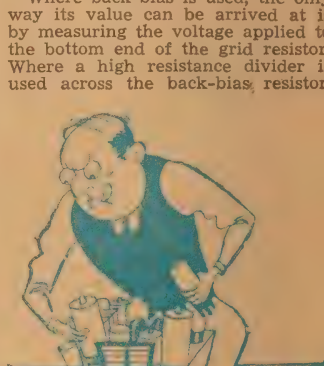
Thus, there might be 15 volts across a 500 ohm resistor, as already suggested. If two 0.1 meg. resistors are connected in series across the 500 ohm unit, the resultant value and the total bias would not be effected to any extent. However, at the junction of the two resistors 7½ volts would be available and any other required value could be obtained simply by varying the proportion of the two resistors.

The method has the advantage that effective hum filtering can be provided by bypassing the junction of the high value resistors with comparatively small condensers. On the other hand, filtering in a circuit involving only a few hundred ohms is very much more difficult.

**How can one measure the actual grid bias if it cannot be done with an ordinary voltmeter?**

You can forget the "if," Tom, because bias cannot be measured easily through the usual high resistance grid circuit. An ordinary voltmeter has an effective internal resistance of only a few thousand ohms and its connection to the grid completely alters the operating conditions.

Where back-bias is used, the only way its value can be arrived at is by measuring the voltage applied to the bottom end of the grid resistor. Where a high resistance divider is used across the back-bias resistor



it is necessary to measure the total bias, then check the values of the divider resistors and do a little figuring to work out the proportion available at the valve.

All this assumes that the valve is not drawing grid current, or that the bias is not being upset to some extent by a small leakage through a coupling condenser or such like, connected to the grid.

Fortunately, one can get some idea of this by reading the plate current and then noting whether it changes

when a piece of wire is shunted across the grid resistor. If the plate current changes when the grid resistor is shorted out, it is pretty clear that slight current is flowing in the grid circuit and corrective action may be called for.

Incidentally we have not mentioned such specialised instruments as valve voltmeters which can be made to measure grid volts directly. However, it will be some time before you get around to using these, Tom.

**If back bias is built up across a resistor, why doesn't it upset the operation of other valves which draw current through the same resistor?**

Rather facetiously one could say . . . "Because the other valves never get to know about the resistor."

You see, the back-bias resistor is really a part of the power supply and the voltage drop across it can be lumped in with the voltage drop across the windings of the transformer, the rectifier and the filter system. The back bias resistor represents just a couple of hundred extra ohms but it is so placed that it makes available a negative voltage negative with respect to earth.

The only bias which can affect a valve is a voltage inserted between the grid and the cathode circuit. If, perchance, we return the cathode and the grid circuits both to earth, there just isn't any bias on the valve, no matter how much resistance and what-have-you is connected in the power supply.

Thus, it is quite possible to have a back-bias system for the output valve, zero-bias on other valves and cathode bias, if you like, on any that are left.

**Some of your sets use back-bias for all the stages. If I were also to connect cathode resistors to some of these valves, would the bias on them be increased?**

My word it would, Tom. Bias can be applied either as a negative voltage to the grid or as a positive voltage to the cathode. If a valve were operating with, say, minus 3 volts on the grid from a back bias source and you were to connect several hundred ohms of resistance in the cathode circuit, the cathode might easily go 3 or 4 volts positive with respect to earth. Adding the two effects would produce a total bias of 6 or 7 volts.

In an RF or IF stage, this would lead to a drastic reduction in overall gain. In an audio stage, the provision of extra—or should we say excessive bias—would lead to distortion.

**What happens in the case of detector and oscillator valves, which appear to operate without bias? Does this shorten the life of these valves?**

Your expression "appear to operate" is very appropriate, Tom, but appearances can be deceiving.

Externally an oscillator valve or a grid detector do not appear to make provision for bias, because the grid return resistor is always taken back to the cathode or filament. Even where a cathode resistor is provided for a second tube section, as in a converter valve, the oscillator grid resistor ducks straight back to cathode, thus obviously avoiding bias for the oscillator section.

But here's the point: The moment the oscillator commences to operate, its grid swings positive over parts of the oscillation cycle, grid current flows and builds up a bias across the grid resistor. You can measure the current with a milliamp meter or measure the voltage with a suitable probe-type valve voltmeter. The condenser, which is always included, prevents the coil from shorting out the resistor and also has a storage effect on the grid voltage which is generated.

So there it is, an oscillator generates its own bias. As a rule, the plate voltage on an oscillator is limited or fed in such a way that nothing too drastic happens if the stage stops oscillating, but such is not always the case. An oscillator is best kept oscillating for its own protection.

As for a grid detector, it is supposed not to oscillate, even though it may be brought very close to the condition to obtain maximum gain. In this case you will always find that the plate is supplied from a low voltage supply or through a large resistor, so that high plate current cannot flow, even with no effective bias on the grid.

And, last, but not least, a grid detector is one of the few circuits which requires zero bias for its correct operation.

# Let's Buy An Argument

So many letters have come to hand during recent weeks that we had to abandon any idea of displaying or quoting them all. Every one has been carefully read, of course, but for the purpose of publication, we have been forced to select excerpts only, from those which best represent certain trends of thought.

by W. N. Williams

ONE such trend is likely to prove an embarrassment personally, unless something is done about it. Too many people are "agreeing with Mr. Williams" that expensive amplifiers are not warranted and you can't tell the difference anyway. Now wait a minute!

Carried to the bitter end, this might suggest that "anything goes" in the way of an amplifier and that readers who have spent a lot of money on expensive outfits have been sold electronic "pups."

## SUBTLE DIFFERENCE

For heaven's sake, let's get the position straight. One objective of the first article was to dis-abuse those who were kidding themselves about "Subtle differences" between a lot of perfectly good amplifiers, whilst using records, pickups and speakers with very serious and very obvious limitations.

It is plainly futile to fret about fractional percentages of distortion in the amplifier, while 10, 15 or 20 per cent is being inflicted on the system by the devices fore and aft.

I contend that many preferences were based on the conflict (or combination) of random qualities, affecting distortion and frequency response; that the proper approach was to study carefully each link in the chain and to apply quite deliberately whatever compensation was necessary to achieve the required end result.

It didn't matter very much, in the meantime, whether the basic amplifier was very good or just plain good.

But what do I mean by a "good" amplifier? The answer can only be very general but the group would include plenty of transformer-coupled triode outfits, the ever popular phase-splitter to pentodes-with-feedback circuit and even many single-enders within their power limitations. It must be assumed that the circuitry is right, that a good output (or interstage) transformer has been used and that the treble has not been poured down the drain by reason of Miller effect and capacitive losses.

## NO PROPHET!

Take any one of these very ordinary amplifiers, fit it out with a good compensating pre-amplifier and it'll out-perform electrically the accessories you can buy today for home listening.

Not being a prophet (or the son of a prophet), I can't forecast whether future pickups, speakers, records and programmes will show up the difference between the good and the very good amplifiers. Of course, those who have invested in the big 807 triode jobs need have no apprehensions on this score, which is probably reward enough for the effort to build them.

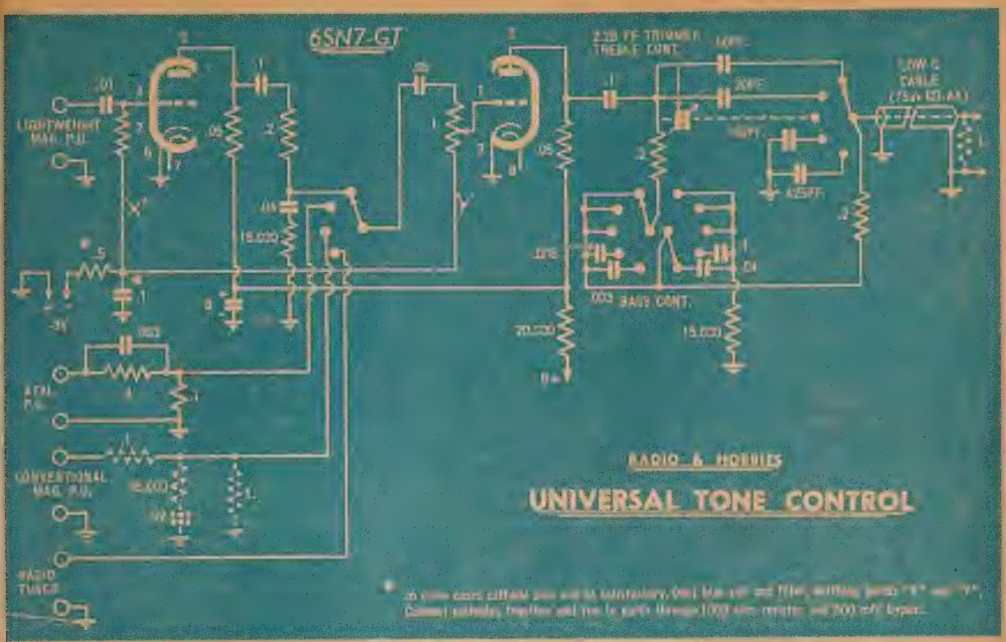
One thing is certain, however. A lot of poor amplifiers will show up badly by contrast, under the strain of reduced background noise and wider dynamic range.

Turning now to some individual letters, I must acknowledge a lengthy and well-informed screed from Mr. Small, of Albury.

## OUR EARS

He fully agrees with my remarks about phase and direct coupling but suggests that treble losses, due to Miller effect, &c., are of little consequence in the average system, which is limited—or has to be limited—to 7 or 8 kc at the top end.

That may be true enough, but the curves published with the Miller effect article told their own story. You can judge for yourself how important it is for those who have




A good tone compensating system, connected ahead of a standard amplifier can work wonders in the final result. This circuit provides a channel selection system and suggests compensation for various types of input. The variable compensation operates on all channels.

a wide-range speaker and pickup combination.

So far so good, but there's one paragraph in Mr. Small's letter worthy of special mention.

*"I am not stating that an amplifier doesn't drop off quite a few decibels . . . but so do a lot of other things and OUR EARS are no exception."*

Several readers have raised this point but it is wide open to question, so long as the listener retains useful perception in the upper register. The response of individual ears to harmonics and overtones may differ considerably but every listener establishes a certain reference quality for the original sound. Let that sound be reproduced without its important harmonics and they will certainly notice a difference.

## SAPPHIRE POINTS

The human eye isn't at all even in its response to color but pictures would still look pretty wishy-washy if you left out the deep reds and the deep violets. Of course, if the subject is color-blind or tone deaf, he never would appreciate the difference.

Jumping over a couple of pages, I find this further sentence:

*"It would appear that sapphire points do not reproduce frequencies above 7 or 8 kc as efficiently as a flat amplifier could feed them to a speaker . . ."*

If the remark is directed at the sapphire as a reproducing stylus, then I must take exception. No needle is perfect but, in the effort to reproduce extreme frequencies, a jewel tip is the only one worth considering. Thorns and steels just won't hold their shape.

On the subject of frequency response, Mr. Small makes some interesting quotes from an article published recently from the Jensen Speaker Company (America).

## HEARING RANGE

The paper points out that persons with exceptionally acute hearing can perceive from 16 to 22,000 c/s at near-pain intensity but a range of 40 to 15,000 will transmit orchestral music with full fidelity. However, subjective tests, taking into consideration home listening conditions led to the following conclusions:

*"It can be shown that, for symphony orchestra music, the average listener can perceive a frequency range from 175 to 5800 c/s while for a critical listener, the range is from 120 to 12,000 c/s at a reproduction level of 55 db.*

*"At a reproduction level of 75 db the critical listener can perceive a range of from 60 to 15,000 c/s . . . This reproduction level is 13 db below assumed concert hall level and represents about the maximum likely to be employed, on the average, in the home.*

*". . . this indicates that a reproduced band from approximately 75 to 8000 c/s for the average listener and approximately 65 to 11,000 c/s for the critical listener would be practically indistinguishable from unlimited reproduction over the usual range of reproduction levels in the home."*

Writing on the same subject, another correspondent, Mr. Gordon says:

*"From experience over the past two years . . . I have found that an amplifier is far more acceptable to the purchaser as having a real and natural sound if both ends of the frequency spectrum are purposely boosted."*

He further quotes an I.R.E. paper which concludes:

*"Listeners liked a flat system (i.e sound in to sound out) with a wide response or range. On narrow range they preferred humpy ends to the curve."*

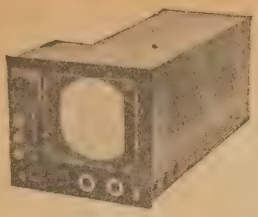
From this, Mr. Gordon concludes: *"If you want to spend a large fortune on equipment . . . then by all means have a flat response. If however, your funds are not those of a Rothschild, make a fairly simple job and bump up the sensitivity at each end of the band. Psychology aided by our unpredictable ears, will have you just as pleased."*

## BOOSTING

Well, yes and no, Mr. Gordon. A spot of boosting in the amplifier proper will offset to some extent the limitations of the accessories fore and aft.

Extra brightness and boom can often be mistaken, too, for extended or even "flat" bass and treble.

The effect can be pleasing but it is synthetic and, after a while, your ears will probably tell you so. I have found that reproduction on this basis has a predeliction to "thumpy"



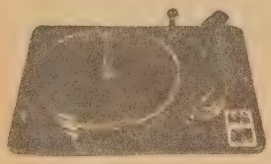
## CATHODE RAY
### Indicator Unit Type A1

This is an Ideal Unit to be converted to an oscilloscope or stripped for the excellent parts, valves, etc.

Parts are:

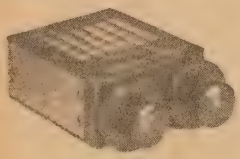
1—5BP1. Valve complete with socket and nu-metal shield.
6—6AC.7. (1852) Valves.
3—6H6. Valves.
12—Potentiometers.
10—Block Condensers.
40—1 watt. I.R.C. Resistors.
1—3 position 2 bank Switch.
1—Toggle Switch.

All enclosed in neat metal case as illustrated.
Easily worth £25.
OUR PRICE .. .. .. .. .. £8/10/-



## PLESSEY
## RECORD CHANGERS

We have a few of these well-known British Made Changers left. They play 10 inch and 12 inch records mixed, and have excellent tone. The price is, each .. £11/10/-

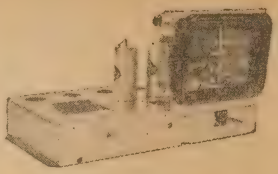


## BUZZERS

Excellent Army Type Buzzers with two adjustments as used in Don 5 and Freddie Telephones. Just the thing to learn the morse code. PRICE, ONLY .. .. .. .. .. 4/6

Army Type Morse Keys .. .. .. 3/6

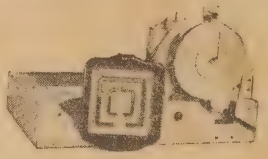
Complete Morse Code Practice Sets, built up on Testboard with battery .. .. .. .. .. .. .. 10/-



## FERROTUNE
## FOUNDATION KITS

made by Kingsley Radio.
TYPE KFT1

Consists of Chassis, Straight Line Dial, Ferrotuned Aerial and Oscillator Coil Kit (no gang required) and 2 IF Transformers. Will build up into a really efficient and reliable radio.
Usual Price £5/18/-.
OUR PRICE .. .. .. .. .. £3/10/-



## FERROTUNE
## FOUNDATION KITS

TYPE KFT3

Consists of Chassis, square dial, Ferrotuned Aerial and Oscillator Coil Kit (no gang required), and 2 IF Transformers. Can be built into either straight or reflexed 4 Valve Broadcast Miniature Receiver.
Usual Price £5/12/-.
OUR PRICE .. .. .. .. .. £3/5/-

## HEADPHONE SETS

Dynamic Headphone Sets with lead, in excellent condition.
These sets are easily worth £4 per set.

Our Special Price is only .. .. .. .. .. .. .. .. 15/-

Transformers to suit headphones. Each .. .. .. .. .. 4/6

Transformers to suit microphones. Each .. .. .. .. .. 4/6

## LOOP AERIALS

Use low loss plastic covered wire. Suitable for all standard sized portables.
Easily worth 10/6.
OUR PRICE .. .. .. .. .. .. 4/-

## CAR RADIO AERIALS

Job Line. 2-piece Aerials. Brass Chrome plated. Less Insulators. 5' 6" fully extended.
Easily worth 25/-.
OUR PRICE .. .. .. .. .. .. 12/6

Job Line. 4-piece Aerials, Brass Chrome plated. An excellent aerial which is extremely small when collapsed. Easily worth 45/-.
OUR PRICE .. .. .. .. .. .. 25/-

## PHONE PLUGS & JACKS

As illustrated. P.M.G. Plugs, brand new and perfect .. .. .. 2/6

Single Circuit Jacks to suit .. .. .. .. .. .. .. .. 2/9

## *NOTICE*

**ALL PARCELS WILL BE SENT REGISTERED POST UNLESS OTHERWISE STATED**

*Postage or freight must be included with order.*

**M/S Motor Spares Ltd**
547 ELIZABETH ST. MELBOURNE.

pass and to streaky "zizzy" treble, which varies from the pleasing to plain annoying.

True flat response—if you can afford and arrange it—is "safer." It sounds consistently better and it is much less likely to pick out imperfections in the programme and hurl them at you with undeserved emphasis. In other words, there is no chance of the peaks in your own outfit coinciding with those already in a faulty signal.

So far so good, but at the end of his letter, Mr. Gordon attacks my ideas of theory and practice and, in so doing, leaves himself wide open. Judge for yourself.

## VALVE OPERATION

Says Mr. Gordon:

*"One may draw a circuit for a 6V6 calling for 12.5 volts bias and a 12,500 ohm load. To put this into practice one must have (A) a plate supply as immovable as Mt. Everest (B) a 6V6 that follows the curves exactly and (C), an impedance that is invariable at 5000 ohms."*

*Then again, "You can design a 15 valve amplifier with 30 db of feedback from output to input, but, boy oh boy, try to make it go in practice."*

Well, Mr. Gordon, I have, during a brief existence, taken many valve curves for publication and know the care with which "average" valve samples are selected and operating conditions kept under control. All valves are held within certain tolerances during manufacture and "theory" will tell you, not only what a reference valve is supposed to do but what percentage variations can be expected from the published design centre values.

The same goes for the effects of reactive load, line variations and all the other snags your fertile mind can invent.

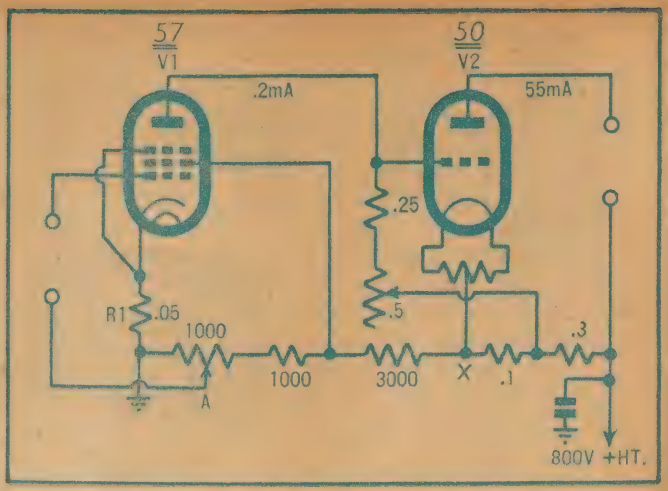
As for the amplifier with feedback, I agree that you can run over a circuit, mark the various grids and plates with plus and minus signs and assume that feedback will be negative with this point connected to that.

## DESIGN? PHOOEY!

But that isn't design and it isn't theory. The perpetrator would have blissfully ignored phase rotation and phase loop calculations. These latter would indicate the critical frequencies and the degree of feedback likely to produce instability.

Not that I blame anyone for failing to work it all out, because it is rather heavy fare. But the point is that the full theory is there if you want to use it. And, if my guess is any good, the aforesaid theory would forewarn you that the proposed design was impractical, thereby agreeing with the stuff called practice.

Mr. Radcliffe, of Canberra, supports remarks about amplifier per-




A direct-coupled "Loftin White" type circuit suggested by Mr. Radcliffe. That 800 volts . . . . ?

formance generally and stresses the importance of correct tone compensation. But, to demonstrate his impartiality, he proceeds thereafter to defend direct coupled amplifiers, which are apparently my "pet aversion."

I quote . . . *"Of greater importance is the pickup, tone compensation system and the speaker. This becomes obvious when you consider that the cheapest mantel radio sounds better on live programmes than on recordings, while feeding the output of the same set into a first class speaker system (preferably multi-speakers with dividing networks) makes a staggering improvement.*

*"In short, have a good amplifier by all means but, if cash is limited, spend less on the main amplifier and spend more on the accessories.*

*"Even a Williamson sounds sour if there is hum . . .*

*"Speaker placing and room acoustics receive far too little attention . . ."*

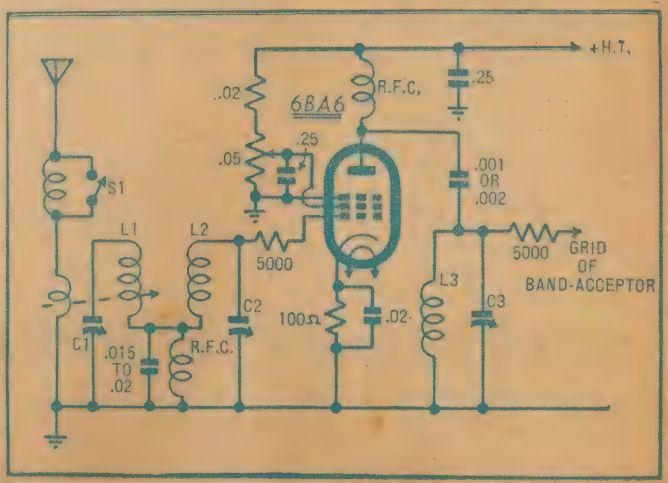
*"Finally I'll stick my neck right out and utter a word in defence of direct coupling, or rather the old Loftin-White method . . . Not because I think it is better, but because I think it gives the best results per pound of capital outlay. The original Loftin, now practically forgotten, is worth studying in the light of modern conceptions of negative feedback."*

There is no need to comment further on the first few points, but I can't let the reference to direct coupling pass.

## UNUSUAL QUALITIES

The original Loftin-White circuit was indeed very popular, but one must remember that it had to compete only with very dubious transformer coupling and with valve and component difficulties which made resistance coupling much more tricky than it is now.

The combination of triode output, the absence of questionable con-




An R.F. stage suggested by Mr. Hosken for use ahead of his band acceptor. It could be the basis of a very effective tuner.

## BENDIX AIRCRAFT COMMUNICATIONS RECEIVERS RA10FA

Frequency range 4 bands 150-400 kcs. 2.0-5.0 mcs, 2.0-5.0 mcs, 5.0-10.0 mcs. H.T. dynamotor 24v input 250v at 100 mA output. Small 24v A.C./D.C. motor. Filaments wired for 6v A.C./D.C. Socket ready mounted and space for rectifier and A.C. power supply. Valves used: 3—6SK7, 6K8, 6R7, 6C5, 6H6, 6K6.

Price, less valves F.O.R. **£11/10/-**

Remote control box with calibrated dial, etc., to suit above. Each .. **35/-**

## 4W FLUORESCENT LAMPS.

Colour: Blue. Length, 5½ inches. Ideal R.F. indicators.

Price, Each .. .. .. .. .. .. .. .. .. .. .. **2/6**

Per Dozen .. .. .. .. .. .. .. .. .. .. .. **25/-**

Packing and Postage, 6d each.

## A.W.A. CRYSTAL CONTROLLED TELERADIO TRANSMITTERS

15/20 WATT.

Frequency Range 2-10 mcs. Valves: 4—Type 6V6G; 1—Type 807. Complete with built-in Vibrator supply for 12-volt operation. Ideal for Ships' communications, etc.

PRICE, Complete .. .. **£25/-/-**

F.O.R.

Excellent Condition.

## DISPOSAL VALVES, TESTED

| | | | |
|---|---|---|---|
| 1K7G .. .. .. | 8/6 | 954 .. .. .. .. | 12/6 |
| 3Q5GT .. .. .. | 10/- | 955 .. .. .. .. | 12/6 |
| 6AC7 .. .. .. | 14/- | 956 .. .. .. .. | 12/6 |
| 6AC7 .. .. .. | 20/- | 9001 .. .. .. | 10/- |
| 6H6GT .. .. .. | 7/6 | 12A6 .. .. .. | 10/- |
| 6SH7 .. .. .. | 8/6 | 12SG7 .. .. .. | 10/- |
| 6SH7GT .. .. .. | 8/6 | 12SK7 .. .. .. | 10/- |
| 6SL7GT .. .. .. | 12/6 | 12SR7 .. .. .. | 10/- |
| 6Y6G .. .. .. | 12/6 | EA50 .. .. .. | 7/6 |
| 7193 .. .. .. | 8/6 | CV6 .. .. .. | 8/6 |
| 852 .. .. .. .. | 25/- | VT90 Micropop | 10/- |

## NEW VALVES

| | | | |
|---|---|---|---|
| 1D8GT .. .. .. | 15/- | 7C7 .. .. .. .. | 11/6 |
| 6B8 .. .. .. .. | 15/- | 7F7 .. .. .. .. | 11/6 |
| 6F6 .. .. .. .. | 15/- | 83V .. .. .. .. | 11/- |
| 6G8G .. .. .. | 12/6 | 811 .. .. .. .. | 70/- |
| 6H6 .. .. .. .. | 10/- | 828 .. .. .. .. | 35/- |
| 6J5G .. .. .. | 11/- | 837 .. .. .. .. | 25/- |
| 6J7G .. .. .. | 12/6 | 866A .. .. .. | 25/- |
| 6K8G .. .. .. | 12/6 | 879/2X2 .. .. | 15/- |
| 6SQ7 .. .. .. | 12/6 | 1294 .. .. .. | 11/6 |
| 6X5GT .. .. .. | 12/6 | 1293 .. .. .. | 11/6 |
| | | VR54/EB34 .. | 5/- |
| 7A6 .. .. .. .. | 10/- | VR65A .. .. .. | 5/- |

## COAXIAL CABLE

Polystrene Insulation.

PS 11/M 72 ohm, 60ft. lengths. Only 5/16 inch O.D.

Price, per length .. .. .. .. **30/-**

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## SCR 522 GENEMOTORS

28 volt input D.C., regulated and filtered output filtered D.C. 300 volts at .26 amps; 150 volts at .01 amps; 14.5 volts at 5.0 amps.

Completely shielded in metal case, 12 x 8 x 5 inches.

Price, F.O.R. Each .. .. .. .. **45/-**

Weight packed, 70lb.

BRAND NEW

## BREVILLE 5-VALVE DUAL WAVE RECEIVER

With 5 spare valves and vibrator cartridge FREE.

6 volt vibrator operated. Attractive walnut cabinet. Brand new, in original packing case. Ex-Amenities. 12 months written guarantee. Large, straight line tuning dial. Instruction sheet supplied with each model. 7-inch permagnetic speaker. Local, interstate and overseas reception.

USUALLY PRICED AT £45/17/6

OUR PRICE, F.O.R. .. **£29/10/-**

## U.H.F. A.S.V. RECEIVERS AR301

Complete with 11 valves: 2—R.F. stages, 954 acorns; mixer and oscillator. 2—955 acorns; 30 mcs. I.F. channel. 4—6AC7's; detector 6H6; cathode follower 6AC7; rectifier 5V4G.

Coaxial switching motors 24-volt D.C. Frequency range, 160-190 mcs.

Weight unpacked, 30lbs.

Suitable with minor alterations for conversion to F.M. Band (88-108 mcs.). Television Band (175-200 mcs.). 144 or 288 mcs. amateur bands.

Complete with valves as above in vented metal case, size, 7½ x 8½ x 18 inches.

Price, F.O.R. .. .. .. .. .. .. .. **£8/15/-**

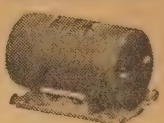
## TELEPHONES Type H. Mk11

Field type complete with magneto, bells and sound-powered push-to-talk handset (no batteries required). Mounted in metal carrying case with strap. Size 10 x 5½ x 4½ inches.

Brand new in original sealed cartons. Weight packed 12lbs.

Price, F.O.R. .. .. .. .. **£3/17/6**

## GENEMOTORS



Command type as illustrated, 28 volts, 1.1 amp. input. Output 250 volts, 60 mA .. .. .. .. .. .. .. .. 32/6

No. 11 type 12 volt input, output 350v. 40 mA. .. .. .. .. .. .. .. .. 30/-

12 volt input, output 480v. 40 mA. 35/-

28 volt input, output 330v. 135 mA. 65/-

28 volt input, output 350v. 350mA. 70/-

## TWIN METER CONTROL UNIT

Comprising: 2 imported 2 inch flush mounting meters, 0-5 mA., D.C. and 20V D.C.; 2 7,500 ohm potentiometers; 7 position 10 amp. rotary switch; S.P.-S.T. toggle switch; plugs, sockets, shock mounts, etc.

Price, Ea. **37/6**

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## METERS

| | |
|---|---|
| 0-30 mA. D.C. 3-inch round flush .. | 25/- |
| 0-30 volt D.C. 3-inch round flush with datum indicator .. .. .. .. | 30/- |
| 0-300 mA. thermocouple. New .. .. | 15/- |
| 0-3 Amp. R.F. thermocouple. New Imported 2" square flush .. .. .. | 17/6 |
| 0-4 Amp. R.F. thermocouple. New Imported 2" square flush .. .. | 17/6 |
| 20 mA. D.C. 300 amp. scale, 3in round flush .. .. .. .. | 25/- |
| 20 volt D.C. 2in. square flush, imported. New .. .. .. .. | 20/- |
| 40 volt D.C. 2in. square flush, imported. New .. .. .. .. | 20/- |
| 50 Amp. D.C. 2in. round flush, imported. New .. .. .. .. | 30/- |
| 20 volt and 200 volt D.C. 2in. round dual reading with leads. New | 20/- |

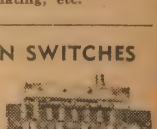
Packing and Postage 1/6 each.

## GENERATORS

12 volt 60 amp. D.C. (F.O.R.). Each .. .. .. **£9/10/-**

Ideal for home lighting plants, battery charging, plating, etc.

## PUSH BUTTON SWITCHES



5-pole each 2 pair of contacts. Made in USA. Ideal for receivers, multimeters, etc.

Price, Each **12/6**

Packing & Postage, N.S.W., 9d; Interstate, 1/6.

# ELECTRONIC EQUIPMENT CO.

Please add exchange to all cheques. Make money orders and postal notes payable at Lewisham. Sorry, no C.O.D.

**—29b West St., Lewisham, Sydney.** OPP. END OF LEWISHAM HOSPITAL (ADJOINING RAILWAY LINE) **LM3555**

densers and the presence of some negative feedback combined to give the circuit what were then rather unusual qualities, provided you could find enough volts to drive it.

But I don't see that it escapes the fundamental criticism I levelled at direct coupling generally. You still have to set the bias by meter or by trial and error and any drift in one valve has a magnified effect on the next. Try to use modern high-slope types and the position becomes down-right critical.

To be sure, there is some feedback present in the circuit, but it is current feedback and it raises the output impedance of the triode so that it begins to look like a pentode. This is hardly what we require for good transient response.

## BAND ACCEPTOR

No, Mr. Radcliffe, direct coupling isn't a pet aversion, but I still think it's the hard way to go about building an amplifier, Loftinwhite notwithstanding.

Of course, I run the terrible risk, in so saying, of having the Editor "request" me to design a direct coupled circuit—objections notwithstanding!

My reference to Mr. Hosken and the complications of his Band Acceptor, recently featured, has called for a rejoinder which is being published forthwith (in precis.).

Says Mr. Hosken:

*"To derive its benefits, there is no need for more than one series tuned band aceptor in a receiver. It would then be placed last in the sequence of R.F. amplifiers. Paradoxically, one of its benefits is simplicity."*

A circuit is appended showing an R.F. stage with band-pass input and a tuned plate output circuit, which is intended to feed into the grid of a single band-acceptor stage. The aerial loading circuit is optional. The "wings" of the band acceptor selectivity curve could be used to offset the taper on the other curves.

## TUNING SYSTEM

Tuning would require a four-gang condenser with frame earthed as normal, coupled to a single gang with frame insulated. All tuning coils would be standard broadcast components and ordinary trimmers would be used for alignment.

*"By comparison with television and F.M. receivers, this must surely be classified as a simple circuit."*

Fine business, Mr. Hosken. If the process continues, we'll end up with something every quality enthusiast will really want to build. Now that four-gang . . .?

Mr. Hosken also comments on the possible effect of phase delay in the harmonic structure of the steep-fronted transients, pointing out that the effect may be more noticeable on these than on regular musical sounds. Clicks are converted to pips . . . &c.

I fully agree and it does not in any way affect my original statement that phase rotation and frequency limitation are alternative expressions of the same phenomena. To reproduce a steep-fronted transient

**(Continued on Page 103)**

# Homecrafts PTY. LTD.

## LARGEST STOCKS KEENEST BARGAINS FOR THE RADIO ENTHUSIAST

"Collaro" Model 504 Gramo. Unit. Synchronous Motor Automatic Stop. Three Models Available.

With Crystal Pickup .. £6 0 0
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HYPERFIDELITY PICKUPS

Headmaster type Pickups. Complete with three cartridges, tonaliser and transformer .. .. .. £10 14 6
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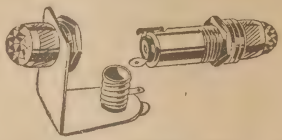
TRIPLE SPEED GRAMO MOTORS

Imported American synchronous type T.S. Electric Motors; 33-1/3, 45 and 78 r.p.m. Complete with turntable as illus. .. .. £12/19/6

RADIO CABINETS

Beautiful walnut piano finish standard model, £13/19/6. Model with deep well for record changer, £14/7/-. Also available in blonde finish Standard model, £16/9/6. Model with deep well for record changer, £16/17/-. Country and Interstate Clients add 15/- packing charge.

The new Palec VCT2 Valve and Circuit Tester. This outstanding instrument is now available for immediate delivery; 10,000 ohm per volt. Will test 800 types of valves. Price complete: £39/15/-, plus S.T. £3/6/3. Terms, £8/12/3 dep., 12/- weekly.



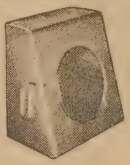
E.M.A. Type F (facetted jewels), wide vision type with nut and spacer for ¾-inch hole mounting, 1/9 each. With back loading pilot light assembly, 3/9 each. Front loading type, 6/- each. Colors: Red, Green. Finish: Nickel Plated.
Type FM Midget Type, ¾-inch diam., with nut and spacer, 1/8.

AMPHENOL STEATITE SOCKETS.

Ceramic 5-Pin Sockets as illustrated. 1/11.

MORSE KEY BARGAIN

Brand new Army type Morse Keys. Small type, as illustrated, only 1/11. Large type, as illustrated, only 2/11.



STREAMLINED STEEL SPEAKER BOXES.

As illustrated. With Brown Crackle Finish. Suitable for Speakers up to 8". As illustrated. Price 28/6.

HOME BROADCASTER MICROPHONES

Will work with any ordinary radio. Adds fun to a party. Cut to only 7/11 each.

CAPITOL DE LUXE CHASSIS SOCKET PUNCHES

The best quality chassis punch in Australia. Made of best case hardened steel. Price, as illustrated, for standard 1" hole, 40/- For miniature valves, 20/-. For new Innoval Series Valves, ⅜", 36/-.

RECORDEX RECORD RACK

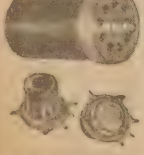
The new improved gramo. record rack. Holds 25 10in. or 12in. records. Complete with index card and gummed identification numbers for records. Price as illustrated, 22/6

PICKUP BARGAIN

English Shefi High Fidelity Moving Coil Pickups. Complete with matching transformer. Reduced from £4/19/- to 29/11, as illustrated.

COUNTRY AND INTERSTATE CLIENTS PLEASE ADD FREIGHT OR POSTAGE.

## DISPOSAL VALVE BARGAINS!!



Type EF50 High Gain RF Pentode, 6.3V. 9-pin lock-in socket .. .. .. .. .. 15/-
Type EA50 6.3V. VHF Diode, suitable for the Vacuum Tube Voltmeter Test Probes .. .. 15/-
Type 954 6.3V. Det. Amp. Pentode Acorn Base. As illus. .. .. .. .. .. .. .. 15/-
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Type 7A6 Twin Diode .. .. .. .. .. 15/-
Type 807 Beam Power Amplifier .. .. .. .. 15/6
Type 100th 100 watt. Triode .. .. .. .. 49/6
Type STV L80/80 Type Multi Circuit Voltage Regulator .. .. .. .. .. .. 14/-
Type 42 SPT 4V. Cosscor Screened Pentode 13/-
Type 5BP1 6.3V. Cathode Ray; 5" screen, elect. deflection. Plus sales tax .. .. .. .. 37/6
Type 7C7 Triple Grid 6.3V. 8-Pin Lock-in .. 15/-
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Type 834 7.5V. 4-pin Power Amplifier .. .. .. 29/3
Type 6SH7 Sharp Cut Off RF Pentode .. .. .. 15/-
Type 830B 10V. Triode, 600 watt. .. .. .. .. 24/-
Type RL18 6.3V. Rigid Wire Base V.H.F. Triode 13/-

10% Discount to Licensed Amateurs.

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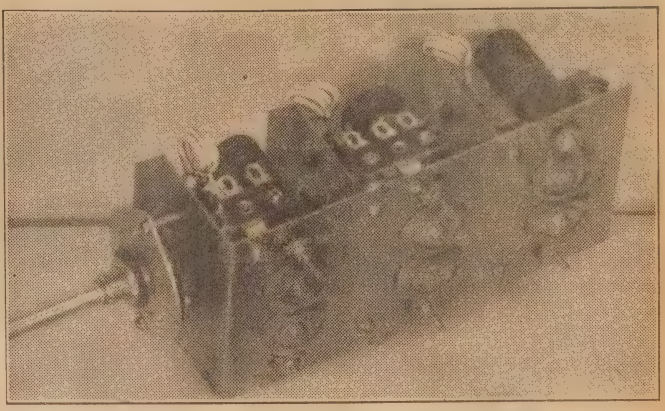
# TRADE REVIEWS AND RELEASES

## "Q-PLUS" INTRODUCE NEW R-F STAGE BRACKET

**Latest release from "Q - Plus" is a dual-wave coil bracket with R.F. stage, which is both compact and attractively priced. Employing single-hole mounting, it should be readily adaptable to most chasses.**



THE body of the unit, excluding shaft and core screws measures 5½ x 2½ x 2 inches. It is subdivided into three compartments housing respectively the aerial, R.F. and oscillator sections. A number of tag strips and flexible leads provide the necessary connections.

A three-position switch is used and there are blank sections at the top of each switch bank for handling dial-lights and pickup-switching as required.

All coils are fitted with miniature variable cores for inductance adjustment, with simple mica trimmers for alignment. High efficiency is claimed, with a sensivity better than 1 microvolt on the broadcast band.

Four different unit types are available at the moment, which cover the most popular converter valves, including the 6BE6 and the battery converter type 1R5. Coverage includes the normal broadcast band and either 13-42 or 16-50 metres on the short waves.

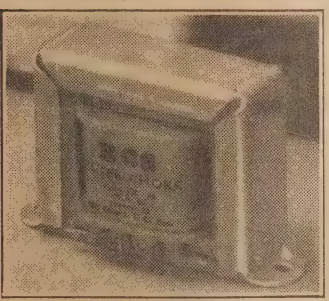
The new units will be available through all "Q-Plus" distributors. Retail price is 95/-.

## FILTER, R-F CHOKES FROM RCS

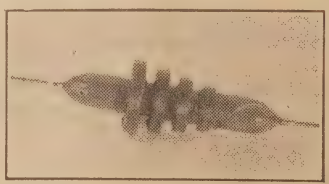
**New components added to the R.C.S. line include a 60-milliamp filter choke and a series of multi-pi R.F. chokes.**

TYPE number of the filter choke is type TC66 and it is rated at 20H., 60 milliamps, with a d-c resistance of 650 ohms.

The winding is carried on a trolitul



bobbin which offers good protection against breakdown to the core. The corners are rounded to obviate



breakage, while "U" shaped terminations are provided for the leads to obviate difficulties which might arise from soldering.

An aluminium clamping bracket also provides mounting facilities.

The R.F. choke illustrated is the RF83 type, with four graduated sections and an inductance rating of 2.5 millihenry. Other types in this range have from 3 to 6 sections and inductance ratings from 1.7 to 9.0mH.

All these components are being handled by R.C.S. distributors.

## TRADE CATALOGUE FROM UNITED RADIO

WE have just received a specimen copy of the new illustrated U.R.D. Catalogue. This complete 52-page octavo publication is an invaluable guide for the radio and electrical trader. All items are listed and the catalogue completely indexed. The retail price is given for each item, together with a discount code. Enclosed with every copy is a confidential discount code schedule.

Copies are available to the trade only from United Radio Distributors Pty. Ltd., 175 Phillip Street, Sydney.

## 'WINDOWMOUNT' AEGIS AERIAL

**Intended for use especially in flats and offices, the Aegis "windowmount" aerial can be installed neatly and quickly.**

THE problem, in steel-frame buildings is often to install the aerial in a position where it can pick up a reasonable amount of signal. Even a wire hung out the window is likely to be still in the "shadow" of the steel frame.

The new Aegis aerial solves this problem in a neat fashion. The complete kit includes a mounting bracket which can be fixed either horizontally or vertically on the window frame. A bakelite moulding, attached to this, supports a screwed, aluminium whip aerial approximately 7ft long.

This is connected to the receiver with ordinary insulated lead-in wire, as supplied. List price for the complete kit is 30/-. Supplies are available through all Aegis Distributors.

# MAXWELLS

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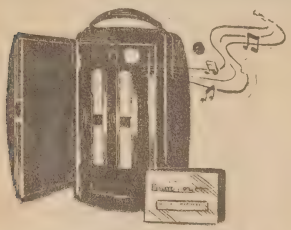

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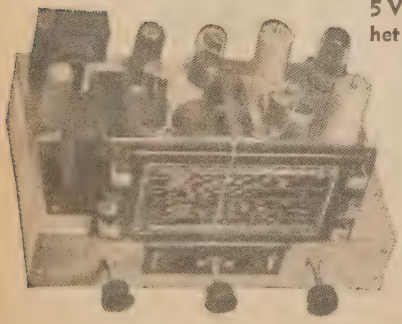

**5 Valve B/C Superhet complete with 8" Speaker.**

**£14/10/-**

This simple to construct set was fully described in R. & H. JULY issue.

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**Same Day Despatch** **Add Postage to all Amounts**

# NEW SPEAKER SOUNDS GOOD!
# WIDE-RANGE ROLA 12-OX

**A few months ago, we heard a new, wide range speaker at the Rola factory in Melbourne, and were impressed with its performance. A sample model of the speaker has now come to hand, and further tests indicate that it fulfills its earlier promise.**

THE type number is 12-OX, indicating that the speaker is really a special version of the 12-0. already well known throughout the country.

This new speaker actually has three cones. The main cone is similar to that of the 12.0, but the surround has been treated with a softener which has reduced its main resonance to 50 cycles per second.

The second cone is a small, free-edged curvilinear type cemented to the voice coil. As an integral part of this cone there is also a dustcap which re-inforces the extreme top end of the scale.

An output transformer is not supplied with the speaker. The makers are quite happy for the user to connect via a high-grade component made by some reputable firm, as against doing the job themselves. The standard Rola transformer, while adequate for the 12-0, isn't good enough to cater for the extreme range of the 12-OX.

Testing this speaker with the audio generator shows a smooth bass response down to 30 cycles or so, without any pronounced cone resonance. The middle register disclosed no obvious peaks or tweets. There appeared to be a drop round about 5kc, the response rising again between 8 and 10kc. The cut-off was quite sharp at about 11½kc.

## LISTENING TESTS

This general performance is very much like the imported twin cone speakers, and the 11½kc limit isn't really important with today's radio and records. It's plenty high!

On listening tests with a wide-range tuner, the high frequency response was immediately obvious in the predominance of the 10kc beat between adjacent stations. On "clean" programmes the reproduction was extremely "live" and realistic, but the distortion from poor programmes and records etc., was most pronounced.

To the seeker after quality, the Rola 12-OX will therefore impose the same requirements as have already been suggested for other wide-range speakers, with present sources of signal. With a wide-range tuner, some trap or filter will be essential in most locations to obviate the 10kc heterodyne.

Some limitation also may have to be placed on the treble response when the speaker is used to reproduce old or doubtful recordings.

In other words, the new 12-OX is not a speaker which should be bought and connected carelessly to any old receiver. The absence of excessive bass resonance and the extended treble response might easily give the effect of distorted, "reedy" reproduction. It will need to be properly baffled, for example with a vented enclosure and preferably used with a treble filter system, which will allow the response to be varied to suit the programme material.

Supplies, when available, will be released through Rola distributors and trade houses. The retail price is under £6.

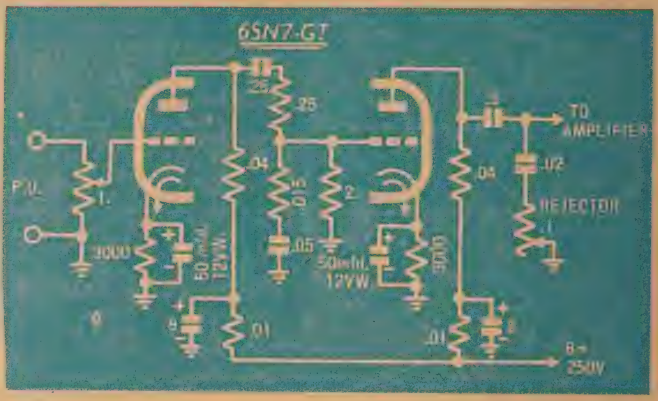
The new Rola 12-OX has three cones giving it an effective response to nearly 12 Kc and a bass resonance of approximately 50 cycles. Used with adequate baffling it provides wide-range listening for less than £6 retail.

# A READER BUILT IT!

**Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.**

## A SIMPLE TONE COMPENSATING PREAMPLIFIER

In common with many other readers who have purchased lightweight magnetic pickups, Mr. H. N. Anderson of Toorak, Victoria, found that the results were not very pleasing when the pickup was fed into a standard medium gain amplifier without tone compensation. His solution to the problem is the simple pre-amplifier with compensation, the circuit of which is reproduced here.




HIGH quality lightweight magnetic pickups in general have a substantially flat output over their working range and at the same time their output is a good deal lower than that of crystal pickups or older magnetic types. At the same time, standard gramophone recordings are made with the bass end deliberately attenuated so that the playing time can be extended.

Without special provision for the new pickups, the amplifier output is apt to sound thin and weak.

Our correspondent noticed this circuit in a back issue of an overseas technical journal. The original used a pair of 6J5s but he found that these tended to be noisy and substituted a 6SN7-GT which completely cured the trouble.

Faults in the individual valves probably accounted for the trouble but it is worth remembering that the overall gain required for a lightweight magnetic is quite high and it is as well to make sure that preamplifier valves are in good condition.

The circuit is very simple and consists essentially of two triode amplifier stages. The volume control is in the input circuit but if this tends to cause noise when the knob is rotated it would be permissible in many cases to place it after the preamplifier.

Fixed bass compensation is achieved by a resistance capacity network in the plate circuit of the first valve and a variable top-cut tone control in included in the output circuit so that the scratch on some of the older recordings can be attenuated. A pair of decoupling networks which are included to prevent motorboating complete the circuit. Note that most pickups will require a load resistance of something like 50,000 ohms. This can be connected in parallel with the pickup either at the volume control or at the pickup, as convenient.

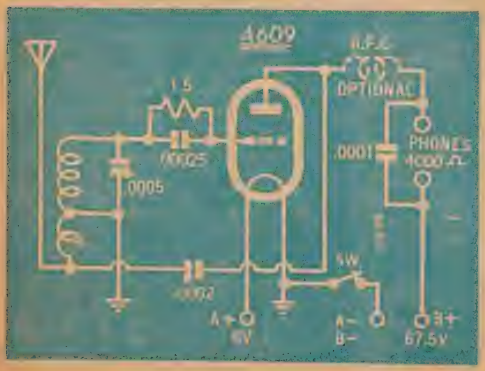
### ONE VALVE RECEIVER

Another reader, Mr. H. L. Briggs of Devonport, Tas., sends in the circuit of a one valve receiver about which he is very enthusiastic. Apparently the original used the 6 volt A609 triode but there are many other valves which could be used just as successfully provided suitable adjustment to the filament voltage is made.

The two volt type 30 is a good choice and frequently this valve will work quite well with an ordinary 1.5 volt torch cell for the filament supply. In the 1.4 volt series the 1H5-GT can be used. Simply ignore the diode connection.

Our correspondent's circuit shows the R.F. choke as an optional component but we suggest that it is a good idea to include it, otherwise the setting of the reaction control is likely to be unstable. By the way, we suggest that the switch be placed in the positive filament lead rather than the common negative lead.

Should the high-tension accidentally be shorted to earth with the present connection, the filament of the valve will be damaged.




The coil consists of 110 turns of 30 gauge wire in the case of the grid winding and 30 turns of 36 gauge in the case of the reaction winding. The windings are side by side on a 1½" former.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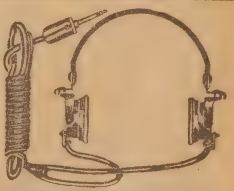

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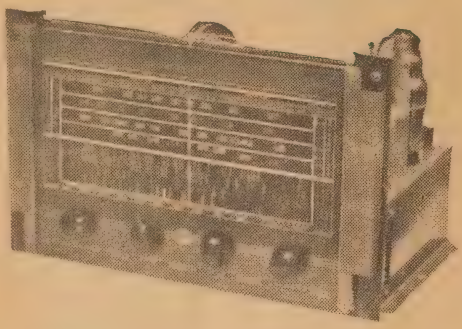

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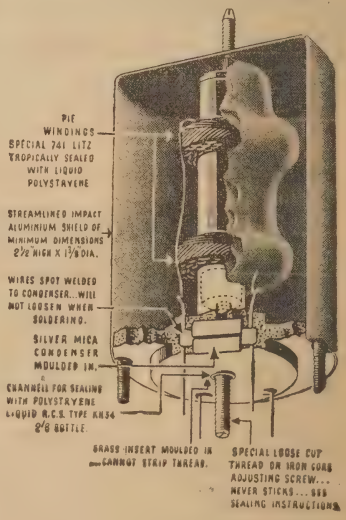


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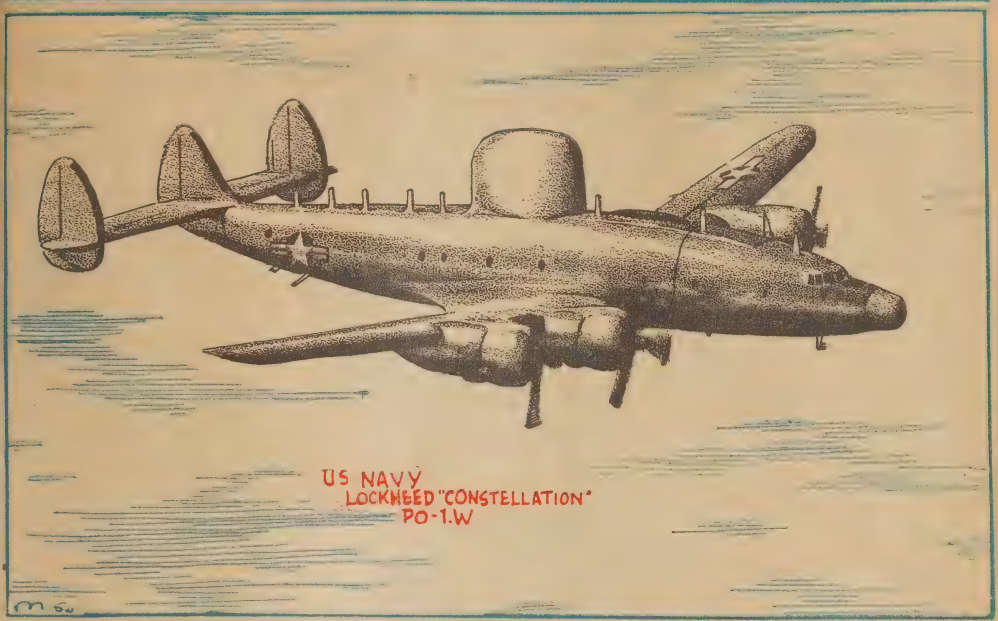



**Familiar on many of the world's main skyways as a luxury airliner, the Lockheed Constellation has now made its appearance as a long-range radar patrol plane that will extend the range of "vision" of the Fleet. Early this year the US Navy disclosed the existence of this "flying laboratory." It was revealed that the modified Constellation, given the official designation PO-1W, would carry and test airborne early-warning equipment designed for faster detection and location of hostile air and surface forces.**

PHOTOGRAPHS of the PO-1W released officially show two large "radomes," one on the top of and the other below the fuselage. These undoubtedly house scanning antennae. There are rows of antennae on both upper and lower exterior surfaces, while an elongated nose structure is a noticeable alteration to the familiar Constellation outline.

Basically, the Constellation is a low-wing monoplane with a sleek, finely-streamlined fuselage that gives a curious dolphin-like outline. A distinctive feature is the triple-finned tailplane of unusually great width. The four motors each develop more than 2000 horsepower.

The PO-1W, specially modified by the Lockheed Aircraft Corporation of Burbank, California, underwent a long series of tests by the factory before being handed over to the US Navy for tests of its early-warning radar devices and procedures.

Reports at the time of the completion of the factory tests emphasised the value that was being placed on the use of such an early-warning radar plane, able to patrol well in advance of the fixed ground installations and relaying information on impending attacks well ahead of the surface radar system.

Radar cannot "see" beyond the optical horizon since the high frequencies that are employed do not bend around the earth's surface. The only way to extend the range of radar, is to take it aloft so that its horizon is greatly extended.

## RANGE LIMITS

Shipboard and surface radar can "see" only to the optical horizon and enemy aircraft may, therefore, get in "underneath" its searching electronic fingers and may be undetected until they are well in towards the ground defences.

Airborne early-warning equipment located in a high flying aircraft patrolling many miles in front of a threatened point can see further down the horizon. Approaching aircraft or ships can thus be picked up much earlier than would otherwise be possible.

When a hostile aircraft is spotted by airborne radar, word can be radioed back to the ground station, alerting it for action and giving the location and direction of the impending attack.

The PQ-1W shares with its "parent" Constellation the ability to stay aloft for many hours and to cover great distances.

Its flying crew of pilot, co-pilot, flight engineer, radio operator, technicians, and radar operators, have bunks available for relief of crew members on long patrols.

Flight tests are reported to have disclosed that the bulky radomes and other external devices do not materially affect the performance of the aircraft.

With its great range—over 5000 miles non-stop—the PO-1W can remain aloft for periods on patrol missions from shore stations.

Top speed is 350 miles an hour, providing operational flexibility, since the aircraft can reach its patrol station quickly or be diverted to some new danger spot.

# HOW TO MAKE A DRILLING STAND

**Many times the home constructor needs more than two hands to negotiate a ticklish drilling job. A drilling stand is the obvious answer. This article tells you how to make such a stand from easily obtained materials.**

THIS drilling stand is intended for use with one of the well-known type of breast drills having a length of plain spindle at the end remote from the drill chuck.

The base for the stand is composed of a piece of hard wood, 12in x 7½in x 1½in thick, care being taken to ensure that it is flat. The column

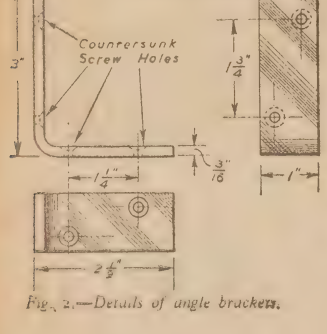



*Fig. 2.—Details of angle brackets.*

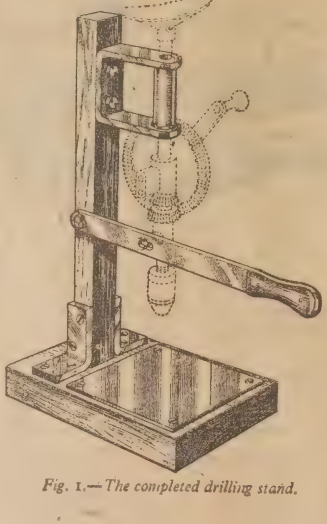


*Fig. 1.—The completed drilling stand.*

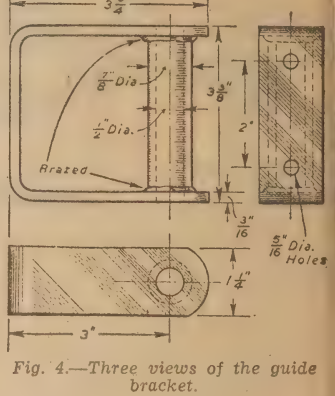



*Fig. 4.—Three views of the guide bracket.*

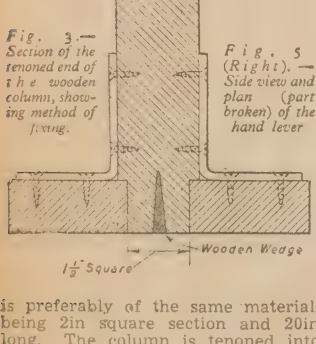



*Fig. 3.—Section of the tenoned end of the wooden column, showing method of fixing.*

*Fig. 5 (Right).—Side view and plan (part broken) of the hand lever*

is preferably of the same material, being 2in square section and 20in long. The column is tenoned into the base as shown in Fig. 3, ensuring that the column is square both ways with the base.

## GUIDE BRACKET

The two angle brackets (Fig. 2) can be secured to the base and column by means of wood screws (Fig. 3); these will give added strength and, provided that the brackets have been squared up accurately, they will ensure that the column remains square to the base. A piece of 3/16in M.S. plate is screwed on to the wooden base to form the drilling table, as indicated in Fig. 1.

This is made by bending a piece of M.S. to the shape and dimensions shown in Fig. 4, the two guide holes being drilled after bending. While drilling, the bracket should be packed with a piece of wood to avoid springing; the two holes are drilled slightly under ½in.

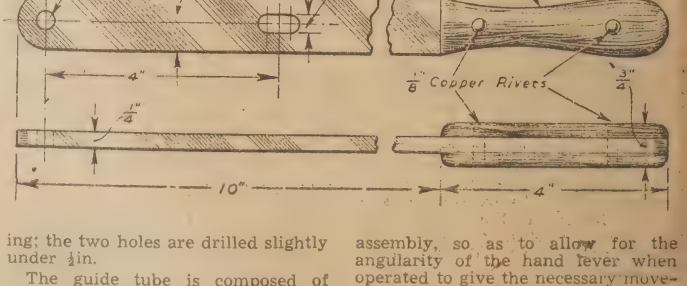
The guide tube is composed of brass and can either be turned or a piece of brass tube used, but in either case the bore must be slightly under ½in. The ends of the tube are faced or filed until they are a good fit inside the bracket. A ½in bolt is then passed through both the bracket and tube and tightened. Due to the small bore, the bolt may have to be filed down slightly to suit.

The tube can now be brazed to the bracket as indicated in drawing. After brazing, the bolt can be removed and the bore reamed out with a ½in reamer so as to form a good fit on the breast drill spindle.

The complete bracket can be bolted to the column of the stand by means of two 5/16in bolts.

## HAND LEVER

This is made of M.S. and constructed as shown in Fig. 5. The elongated hole is filed to suit on assembly, so as to allow for the angularity of the hand lever when operated to give the necessary movement up or down.




## ASSEMBLY

Care must be taken on assembly to leave enough room between the chuck and table to allow for the largest drill used and also a medium-sized job.

When drilling with short drills, the job will have to be packed up to the required height by means of wooden blocks.

# RADIO CONTROL FOR MODEL AIRCRAFT

**The final instalment of a series of articles on the radio control of model aircraft. The same type of equipment can be used to control other models. Details of the author's latest apparatus are given here.**

**By GIL MILES**

A SIMPLE receiver designed around the now available Hivac ub-miniature gas triode, the XFG-1, shown in fig. 32 with a typical rcuit in fig. 30.

*The manufacturers of this valve ate: "The useful life of the XFG-1 critically dependent upon the peak node current, which is determined y the precise circuit condition and not readily measurable. The mean node current can, however, be easured and should, if possible, e adjusted to 1.5 mA or less in rder to prolong the valve life as uch as possible."*

The variable resistor in the anode rcuit and the antenna length are oth used to adjust the anode current the preferred value. Many varia- ons of this circuit are possible and lthough differences were noted be- ween individual valves, the two ad- ustments mentioned will take care f each case.

The standing current of 1.5 mA hould drop to approximately 0.2 mA /ith a strong signal and to approxi- nately 0.5 mA with a weak signal.

A companion transmitter to the FG-1 receiver can be built around 3A5 or its equivalent the Mullard CC90 valve. It will prove a stable scillator providing precautions are aken to see that all leads are short nd rigid, especially the tuning coil nd its mounting.

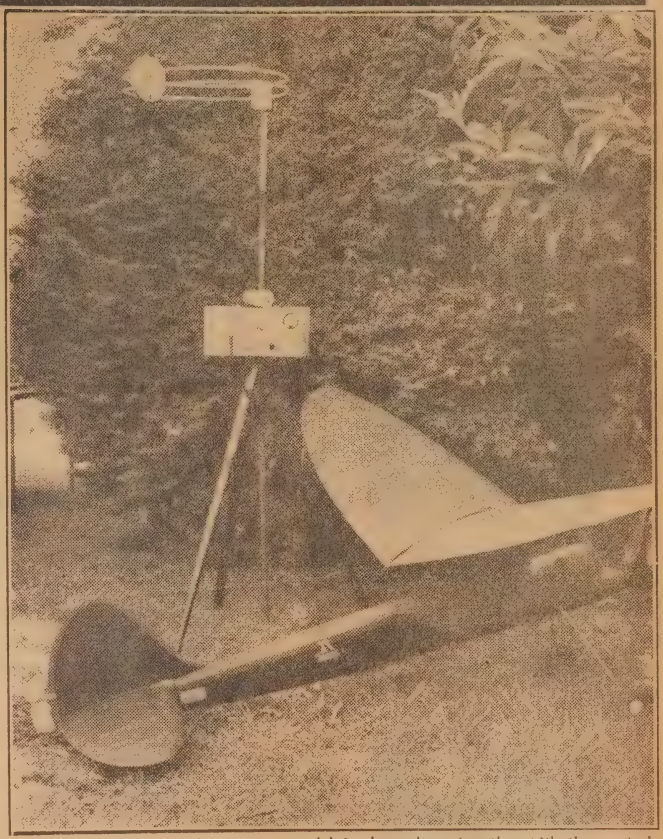


Fig. 34 The author's 9ft wingspan model is shown here together with the control transmitter and aerial. The small switch box can be seen lying on top of the transmitter. Note the halo aerial which gives all round horizontal polarisation.

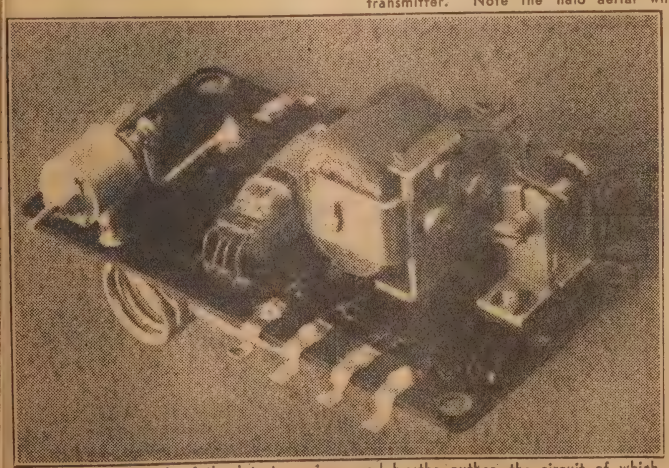


Fig. 32 Photograph of the latest receiver used by the author, the circuit of which is shown at Fig. 30. The coil is seen under the panel with the tuning condenser above. Then comes the thyratron and the relay operated escapment.

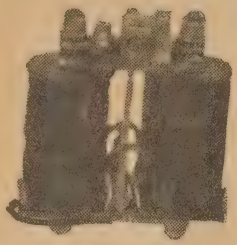
These valves are operating within their rating with 2 watts input and when coupled to an antenna cut to the dimensions as shown in figure 31, will give plenty of output even at 40mc/s.

Keeping the antenna height between $\frac{1}{4}$ and $\frac{1}{2}$ wavelength above ground is good practice, and if necessary in the interests of portability the outer $\frac{1}{4}$ wavelength section of the top could be folded at right angles to the main length, in fact some improvement in the shape of the horizontal all round radiation pattern of a simple dipole can be gained by simply folding the antenna in the shape of a sine wave i.e. when looking down on it from on top.

Fixed to the tail unit and shown in figure 35, can be seen the rotating vane, which can be stopped in either of two positions to give rudder left or rudder right movements to the model.

So that tests can be carried out in the field and adjustments made with ease, it is suggested that the

# AMATEURS—DISPOSALS—EXPERIMENTERS



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Twin Coil American type, Multiple Switching Contacts.

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**MIDGET GENEMOTORS**

Input—28 Volts at 1.1 Amps.
Output—250 Volts at .06 Amps.
Size—4½ x 2¾. Weighs only 3 1-8lbs.
Perfect for use with 32 Volt domestic Receivers.

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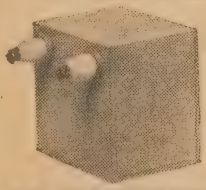

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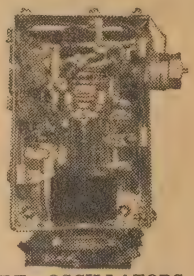

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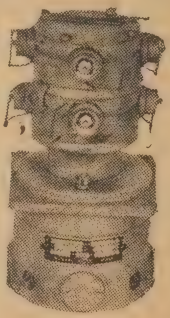
15/-
POST FREE.



**MOTORS**

24 Volt Low H.P. Motors, complete with Coaxial switching Unit. While they last.

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**MISCELLANEOUS VALVES**

EF50 Valve and Ceramic Socket.
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AV11 H/W High Voltage Rectifier.
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6H6 Twin Diode (Metal)
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| | |
|---|---|
| Oil filled, .01 5000 VW. .. .. .. .. | 5/- |
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Postage 1/6 extra.

**MICROPHONES**

No. 3 Hand as used with No. 11, 101, 109, etc.
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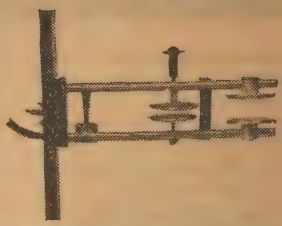
Respirator, Carbon type.
5/- post free.

Double Button Carbon.
6/- post free



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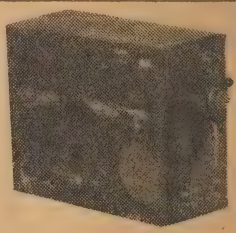

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Ideal for use with Home Built Car Radios. Complete with High and Low Tension Filter, input 12 volt, output 220 volt at 60 ma.

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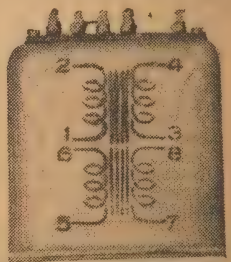


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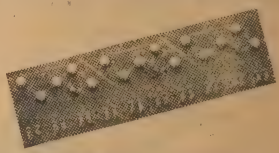

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# PARAGON RADIO

*Available also at—*
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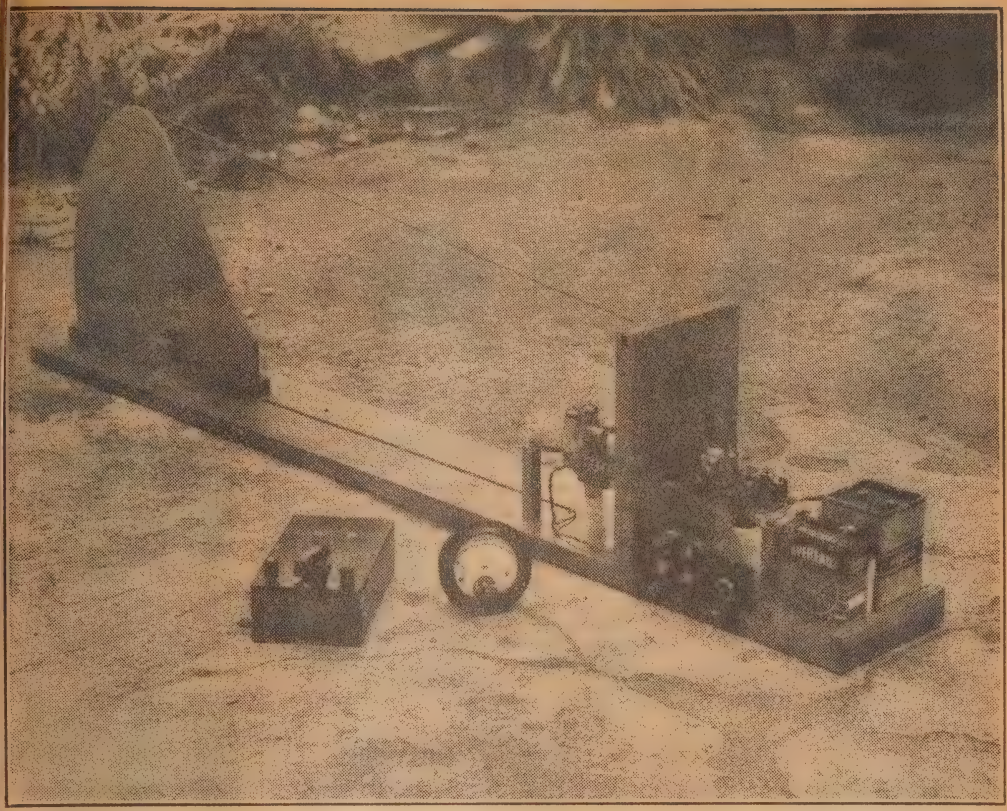

Fig. 33 Above is a complete receiving gear set up for field testing. Small dial lamps glow to simulate rudder movement. The meter plugs either into the box to operate as a voltmeter, or into the test panel to check the equipment.

complete receiving system be set up on a board similar to that shown in fig. 33. The simple receiver and escapement would not require so elaborate a setup as that shown, but it is still desirable to mount the components and wiring in similar positions to their final place in the model.

It might not at first be apparent, but the leads to the escapement are part of the antenna system, and for that reason alone, it is worth while setting everything up as described.

When working properly, it is an easy matter then to transfer everything into the model with a reasonable chance of success and, believe me, here is one instance where a haywire installation will be a handicap!

The author's 9' span model, crystal-controlled transmitter and antenna are seen in fig. 34. The model made in Melbourne by Mr. Des Belot, of the West Preston Model Aeroplane Club, has already had two years of free flight to its credit.

The transmitter provides a carrier for engine control and two audio tones as modulation for left and right, each function obtainable instantly and at will without the necessity of going through a sequence.

A control box small enough to be held in the hand can be seen on top of the transmitter in figure 34.

Fitted with a push button switch for carrier cut off and a telephone type key switch for rudder left, right and neutral.

The engine ignition circuit is arranged so that the engine will only run while the carrier is "on," a momentary break of the carrier stops it, thus providing a safety feature should a radio fault develop or the model fly out of radio range.

The two radio units are shock

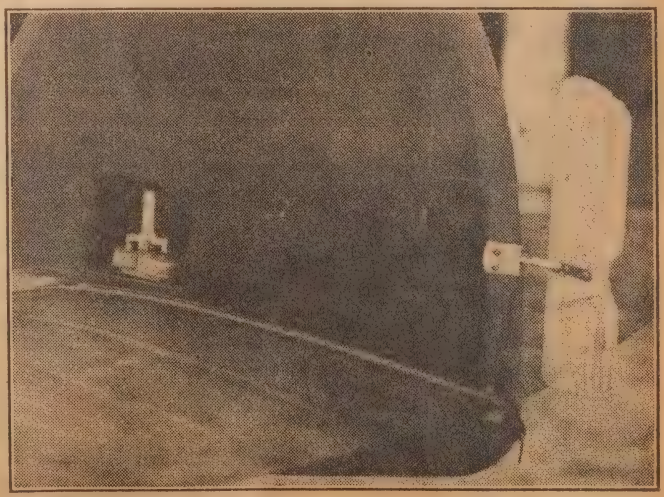

Fig. 35 Here is the control vane mounted on the tail unit of the model with the operating relay inside the stabilizer section.

# Waltham TRADING Co.

393 Flinders St., Melbourne, C.1.

Mail Order Dept., 319 Swanston St., Melbourne.

**COMPASS, TYPE P.8**

5¾in dia. x 2¾in deep accurate Aircraft type navigation compass. Reconditioned as new . . . . . **37/6**

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**R.A.A.F. ASTRONOMICAL INSTRUMENT** can be utilised to measure horizontal and vertical angles such as those encountered in road making and irrigation work. It is fitted with scales calibrated in degrees, two levels and adjustable turntable mountings. . . . . **£2/15/-**

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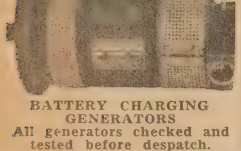

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All generators checked and tested before despatch.

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| 24 Volt, 1500 Watt .. | 12 | 10 | 0 |
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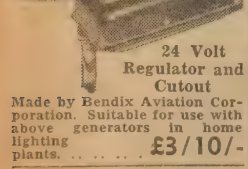
| 12 Volt, 500 Watt .. | 10 | 10 | 0 |

The 24-volt 1500-watt Generator can be used for 32-volt system without any alteration.



**24 Volt Regulator and Cutout**

Made by Bendix Aviation Corporation. Suitable for use with above generators in home lighting plants. . . . . **£3/10/-**

**BLOWER MOTORS.**

80 volt, D.C. with laminated field approx. 1/10 H.P. 45/- EACH

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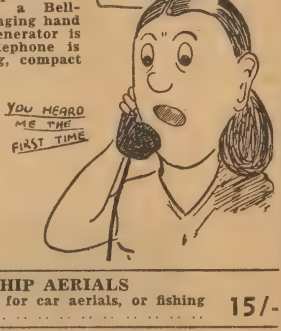
Simple to install by connecting two wires from each unit. No batteries or Power required. Also a Bell-ringing hand Generator is incorporated and each Telephone is contained in a light, strong, compact steel waterproof case. High class equipment that has been tried, tested and proved by the British Army in the field. Effective range, 3 to 4 miles. Complete Set, comprising Two Telephones and 100 yd. Reel of Twin Wire,

**£8/12/6**

Additional Telephones, £3/17/6 each.
Extra Reels of Twin Wire, 17/6 per 100 yds.

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Two four foot sections, ideal for car aerials, or fishing rods. Each . . . . . **15/-**

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Metal pipes and cables can be traced under the ground. This saves the laborious, costly and time-wasting digging of "search holes" when the underground path of the pipes is uncertain, as it frequently is. And throughout all, the metal detector "whistles while it works."

The unit consists of two interchangeable sweep coils, one large and one small, and is complete with carrying pack, valves and headphones, packed in strong wooden transit cases, 10in x 12in x 4ft 6in (total weight 80 lbs.). PRICE £8/10/- EACH, F.O.R.

**AIRCRAFT GILL MOTORS**

These contain a 24-volt motor, approx. 1/10th H.P. that can be revolved in either direction, A.C. or D.C. A magnetic brake and a 5000 to 1 reduction gearbox. EACH, F.O.R. PRICE . . . . . **£2/17/6**

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50 volt 50 cycle, ideal for use with Rotating beam aerials. . . . . **30/-**

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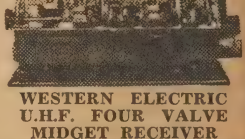

**WESTERN ELECTRIC U.H.F. FOUR VALVE MIDGET RECEIVER**

Frequency 238 to 258 Megacycles Valves 3—945, 1—955 Super Regenerative Receiver. Brand New. . . . . **£2/19/6**

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**AIRCRAFT BOMB AIMING SIGHTS BARR & STROUD MK IX. A.**

Containing liquid damped compass, 5 in. dia. x 2 in. deep, with corrector box, many useful gears and also a rack and pinion. Two spirit levels, etc., in strong wooden carrying box, 12 in. x 23½ in. x 8½ in., which has two mortice type catches and metal handle. . . . . **£2/10/-**

**ELECTRIC MOTORS**

24 volt D/C - A/C. 1/40th H.P. with Laminated field. Brand New. . . . . **£2/10/-**

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unted in the fuselage as near the tre of gravity as possible, with batteries in front of the receiver a separate compartment. During a heavy landing, batteries e been known to come loose and ugh right through the receiver partment!

Reference to fig. 33 will show that all pilot lamps have been inlled, temporarily, in place of the ider actuator and ignition circuit, is making it very easy to see the ult of test signals sent over a itance.

The meter is used to tune the reiver when plugged into one pair sockets, check the relay valves' rrent when plugged into the other kets. When plugged into the kets on the small box it becomes voltmeter, a very necessary piece apparatus to keep a close check all batteries.

The "Halo" antenna was chosen cause it is easy to transport and radiation is horizontal, being actically equal in all directions.

If the transmitter to be used is not crystal-controlled, it is essential that some check be kept on the transmitted frequency. The simple wave meter of fig. 36 and fig. 37, when properly calibrated, will cover both allotted frequencies. It is sen-

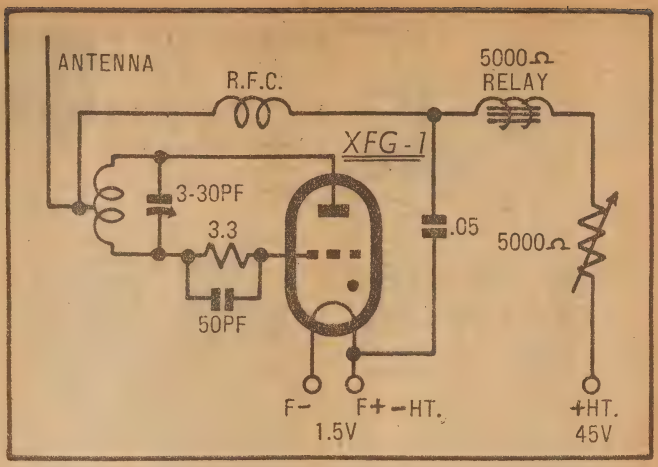



Fig. 30 The circuit diagram of the latest receiver seen in Fig. 32.

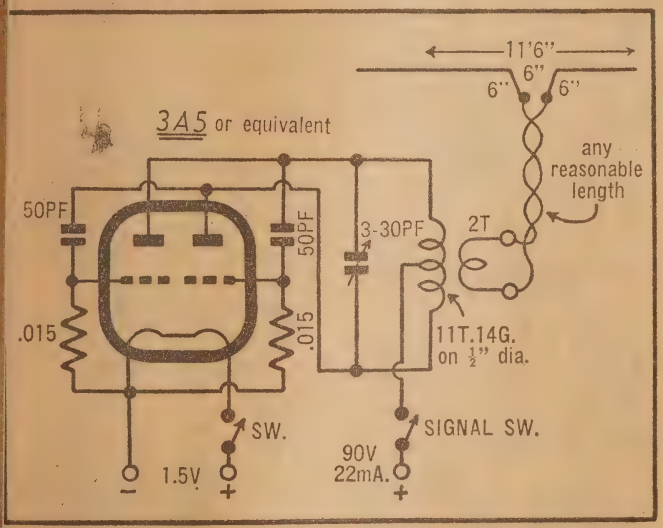
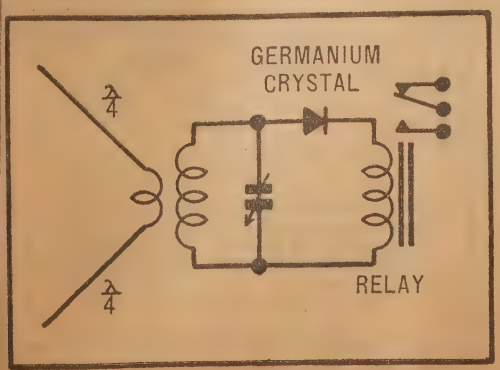


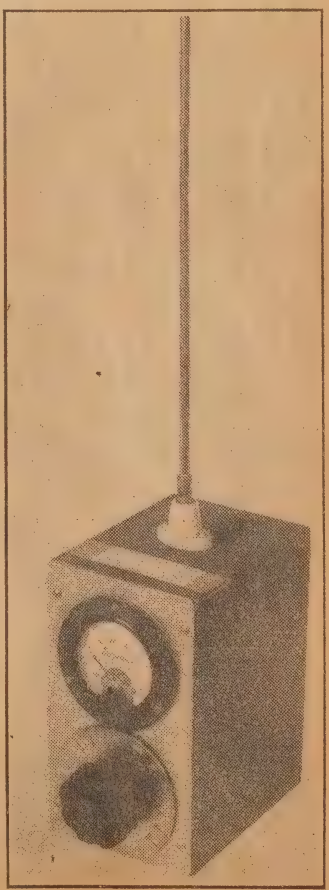

Fig. 31 Here is the circuit of the latest transmitter for the 40 MC band.




Right, Fig. 36 The Wavemeter used to check the equipment for correct operating frequency.

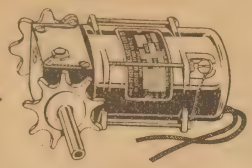
☆

Left, Fig. 37 The circuit of the wavemeter shown in Fig. 36.



**24-volt A.C.-D.C. Geared Electric Motor**

100 Revs. per minute.



55/-. Cost £8/10/-.

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Extra Long Nose Radio Pliers. 8" long, pair .. .. .. .. .. .. 9/6
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Gold Plated .. .. .. .. .. .. 16/6
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SURGEONS' SCALPELS
SMALL 4/6
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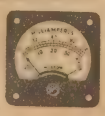
Many other uses — Hobbyists, Chiropody, Photography, etc.

BRAND NEW WESTON DOUBLE READING MILLIAMPMETERS
0-40 0-120, 25/- each.



**Flexible Silver Cine Screens.** 6ft x 42" .. .. .. .. 12/6
**Altimeter or Height Meter.** Lots of interest. Fit one to your car .. .. 30/-
Brand new £3/10/-

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512 ELIZABETH ST., MELBOURNE, C.1.
PHONE: FJ5904. Just 4 doors from

**A Lucky Repurchase.**
**£3/19/6**
**Brand New Army Phones**
**Ideal for Farms**
**Install one in your workshop or house. Equal to P.M.G.**

## Made in England Brand New 5-in-1 POCKET SCREWDRIVERS

Ideal for Engineers, Mechanics, Hobbyists.

5/9

Carry one in your pocket. 5 screwdrivers in one.

## R.A.F. AIR PUMPS AS USED IN LINCOLN BOMBERS

Can be used as Low Pressure Compressors or for Low Pressure Spray Guns, Brazing,

Useful for Gas Torch

55/-

Glass Blowing or Tinning, etc.

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| | | |
|---|---|---|
| 5½ x 5½ | 5/- per pkt. | 144 |
| 8½ x 6½ | 12/6 " | " " |
| 9½ x 7½ | 17/6 " | " " |
| 10 x 10 | 22/6 " | " " |

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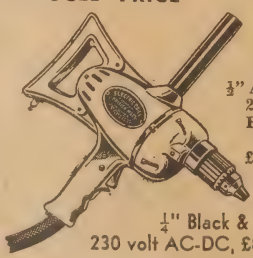

**British Made "Wolf" ¼" AC-DC 230 volt Electric Drills, £15/3/9**

Also ¼" Black & Decker 230 volt AC-DC, £8/19/6

Never again at these prices. Brand new. Limited stocks available. Grinding and Buffing Sets to suit Black and Decker Drills .. .. 25/-

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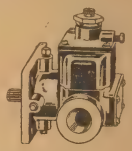
USED BY THE R.A.A.F.

STAINLESS STEEL VANES

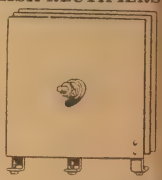


WILL PUMP ANY LIQUID

400 GALS. PER HOUR .. .. .. 55/-
200 GALS. PER HOUR .. .. .. 50/-

**Brand New ENGLISH RECTIFIERS**

Make yourself a battery charger.



6v. 2 amp .. 24/6
6v. 5 amp .. 32/6
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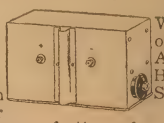
Transformers to suit above Rectifiers, 2 and 5 amp .. .. .. .. 37/6

## AT LAST

**Complete Battery Charger**

Fitted with brand new English Selinium Rectifier



Works off 230v. A.C. Household Supply.

Charges any battery from 2 to 6 volts at 5 amps, £5/15/- complete.

## BRAND NEW CAR FIRE EXTINGUISHER

Genuine Pyrene. Fit one to your car.

Made in U.S.A. Fixed price £5/10/-
**OUR PRICE £3/5/-**

Ideal for Trucks or caravans.

Limited Quantity available.

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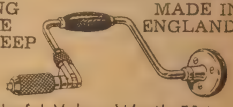
COMPLETE WITH RATCHET BALL BEARING HANDLE 10" SWEEP



NICKEL-PLATED MADE IN ENGLAND.

Wonderful Value. Worth 50/-. OUR PRICE, 32/6. BE EARLY.

**Perspex Sheet takes the place of glass. Ideal for car windows, etc.**

24 x 18 3/32" .. £1/12/6
22 x 14 3/16" .. £1/1/-
18 x 12 3-16 .. 17/6

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**PLEASE ADD FREIGHT OR POSTAGE**

**Mail Orders Carefully Packed**

# STORES

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Victoria Street. PHONE: FJ5904

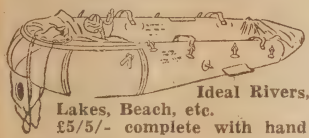
**JUST ARRIVED.** Brand New SNAP SHOT CAMERAS, with carrying strap. Special Price . . 17/6
Cake Mixers, water driven, works off any water tap, as good as electric. Cost £7/7/-. Our Price . . . . 39/6
English 150 amp A.C - D.C. meters, 3½" dia. Ideal for generators 57/6.

**RAAF AIRPLANE COMPRESSOR**
Two Stage
Limited Numbers
Highest Quality
£5/5/-

**DRILLING OR ENGRAVING**

**HANDPIECE**
Brand New . . . . . 20/- each
Burrs 2/6 packet of 5.

**AT LAST AT LAST**
**RAAF RUBBER DINGHIES**



**Ideal Rivers, Lakes, Beach, etc.**
**£5/5/- complete with hand pump.**
Invaluable for flooded areas.

**JUST ARRIVED**
**ARMY GROUNDSHEET AND CAPE**
Ideal for campers, cyclists, hikers

16/6

Direct from English Army disposals

Engineers' Special Outsize Screw Calipers, 4" Dividers and inside Screw Calipers, each . . . . . 4/6

BRAND NEW BRITISH METRO-VICKERS
0-1 Milliampmeters
2½" diameter, 32/6

**IDEAL FOR HOME LIGHTING PLANTS**

**RAAF BATTERY CHARGING GENERATORS**
24 volt 1500 watt . . . . . £13/15/-
Brand New English Lucas, 12 volt 500 watt . . . . . £10/15/-

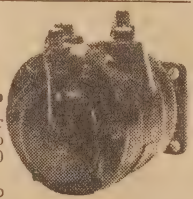
Just what you have been waiting for
**GUARANTEED WATERPROOF SLEEPING BAGS**
Why buy a tent for your holidays? Ideal for campers. Carry one in your car for emergency. . . £4/15/-

AT LAST! British Army Issue
DOUBLE SCALE VOLTMETER
0-15 0-250 VOLTS

IDEAL FOR BATTERY SET USERS AND DEAF AID USERS OR HOBBYISTS

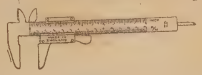
27/6
Worth £3/15/-

**Brand New American Vacuum or Air Pump**



Builds up air pressure to 30lbs. at 1000 R.P.M.
Develops up to 120lbs. per sq. in. of hydraulic pressure, will pump 7½ gals. S.A.E. oil or other liquids per minute. Useful for spraying, milking, presses, oil burners, hydraulic systems . . . . . £3/15/-

**BRAND NEW ENGLISH VERNIER CALIPERS**
Will measure inside and outside. Can also be used as Depth Gauge.



22/6

Ideal for all types of engineering work. Measures in ins. and m/m. Can be carried in the pocket.

**BRAND NEW AIR COMPRESSOR**
2.2 cubic feet, will pump up to 75lb.
**Never before at this price.**

£9/10

Ideal for spraying.

**WATCHMAKERS AND INSTRUMENT MAKERS**


English Tweezers . . . . . 5/6
English Pin Vices . . . . . 6/6
Single Drivers, 5 sizes, 2/6 to 3/6
Eyeglasses . . . . . 6/6 & 8/6
Extra strong double lens eyeglass . . . . . 15/-

**AT LAST: DALTON COMPUTORS. IDEAL FOR AERO CLUBS A.T.C., ETC.**

Only Limited Stocks Available. Be Early.
35/-

Brand New American Weston Voltmeters 0-50V, £2/2/-.

0-50 volts, 0-100 amps, combined. £3/10/-

0-10 Weston Ampmeters . . . . 50/-

Also Metro-Vickers 0-15 volts, 0-600 volts, full scale, 0-500 Microamps. Brand New . . . . . 25/-
A.C.-D.C. 0-20 Milliammeters, 2¾in. dial . . . . . 23/6

**LUCKY PURCHASE BRAND NEW ENGLISH ARMY SPOTLIGHTS**

Ideal for Shooting, Fishing, etc. Fit One To Your Car

29/6

Complete in Carrying Case with Red Amber & Green Discs.

# Telephone FJ5904

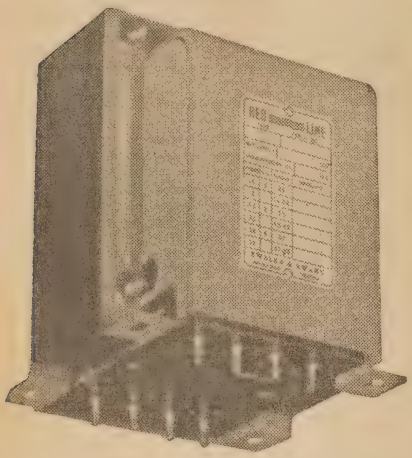
**INCLUDE STATE IN ADDRESS and Efficiently Despatched**

**Just arrived Brand New R.A.F. Flying Suits, guaranteed waterproof, £5/19/6. Genuine English R.A.F. Flying Coggles, MK.7, 37/6 pair.**

RED LINE

# Matched Transformer Kits

## *for the Williamson Negative Feedback Amplifier*



*As originally designed by Mr. D. T. N. Williamson in "Wireless World," April and May, 1947.*

## Output Transformer

Primary Impedance 10,000 Ohms 807 (T) P.P.
Secondary Impedance as required—see panel.*

FREQUENCY RESPONSE: Linear within 0.2 db. 20 cps. to 30,000 cps.

PRIMARY INDUCTANCE (at 5v AC) not less than 100 Henries.

LEAKAGE INDUCTANCE (at 5v AC, 1000 cps.) 17 Millihenries.

INSERTION LOSS: 0.4 Decibels.

## AF Series Output Transformers*

10,000 ohms p.p. plus 34 db primary.

| | | | |
|---|---|---|---|
| 500 & 125 | ohms | secondary | AF 10 |
| 8 & 2 | ohms | secondary | AF 8 |
| 12 & 3 | ohms | secondary | AF 3 |
| 15 & 3¾ | ohms | secondary | AF 15 |

## Condenser Input Power Supply

| | Type No. | Price |
|---|---|---|
| Output Trans | AF* | 127/9 |
| 1 P/Trans | 20453 | 93/2 |
| 1 Choke | 201515 | 36/2 |
| 1 Choke | 50825 | 30/3 |

# RED LINE EQUIPMENT PTY. LTD.

TRANSFORMER ENGINEERS

City Office:
157 Elizabeth St., Melbourne. MU6895

Workshop:
2 Coates Lane, Melb. Central 4773

Distributors:
S.A.—Gerard & Goodman Ltd.
N.S.W.—United Radio Distributors Pty. Ltd.
Q'ld.—A. E. Harold, B. Martin Pty, Ltd,
Vic.—All Leading Wholesalers.

A GUARANTEE OF DEPENDABILITY

tive enough to be used as a field rength meter when transmitting id to pre-tune the receiver.

Just to show that someone has eally tried to simplify this radio ontrol business, figure 38, depicts receiver using a germanium cry- al, a relay and not much else. owever, it took 100 watts of trans- itter power to operate the relay t ½ mile!

The boys who fly indoor model eroplanes get the weight of their odels down to fractions of an unce and even here successful radio ontrol has been applied.

Using a 100 watt transmitter again; is time a receiver containing a bi- etal strip was apparently made to perate a rudder with power from he transmitter, only over a matter f a few feet of course; but very nteresting nevertheless.

Before any control of model air- raft, or, for that matter, of any ther type of model, can be under- aken, special permission must be btained from the PMG Department hrough the Wireless Branch in any particular State. Two frequency bands have been set aside for model control and are subject to the fol- owing conditions:—

The input power to the plate cir- cuit of the transmitter valve feed- ing the aerial must not exceed 2 watts.

The frequency band will not be used for any service except model control. Transmissions shall not cause any interference with broadcast listeners, or with any other radio service.

Licensed amateur transmitters may operate radio controlled models on any of the amateur bands above and including the 144 mc. band, but can only use the two special control bands after obtaining permission to do so.

The frequency bands for which permits will be considered are 26.957 —27.282 mc. and 40,66 and 40.7 mc. The transmissions must lie wholly within these limits.

The PMG will require full details of the experiments to be carried out, together with a description and circuit diagrams of the equipment, both receivers and transmitters, it is proposed to use. The locality of the experiments must also be stated.

Permits if granted are valid for six months from the date of issue. Applicants between the ages of 16-21 years must supply written statement from their parents accepting responsibility for any breaches of regulations which might occur during operation.

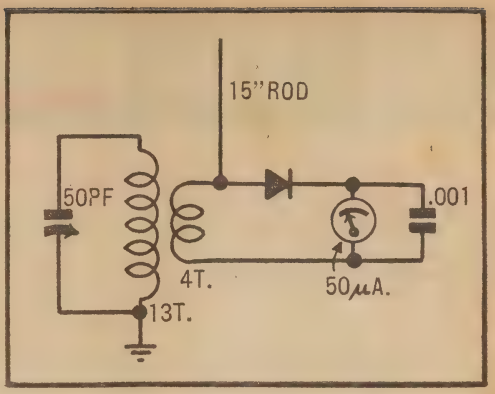



Fig. 38 The circuit of a crystal receiver useful for extremely short distances.

# RADIO IN THE AFRICAN JUNGLE

(Continued from Page 21)

rangements and these are being corrected as production continues. The result should be a very simple but effective battery set, ideal for use by the native population. In fact, many of the sets are being sold as portables and "second sets" to the white population and this fact lends them immediate prestige.

The Government is concentrating on a publicity campaign through the Press and mobile cinemas and is also preparing to sponsor a listeners club, complete with membership badges and listeners' magazine. Additional markets are being opened up in Southern Rhodesia, Nyasaland and other neighboring provinces.

## TYPICAL LETTERS

Letters from the native population, though phrased in primitive fashion, speak eloquently of the impact of the Saucepan Special and the programme which it makes available. Typical letters read: —

*"I have the honor to write this letlle in order to thank you for your kindnesses which the Government of N. Rhodesia has done to we Africans the greatest gift to let we Africans buy the wirles. Indeed we are very much pleased to hear things which was done in every part of N.R. and all over the countries. it is the first gift which we received we Africans of Northern Rhodesia to have the wirles to understand all the words which comes to every contries that is why I write this lettle to give my thanks is I have got a wirles in my house.*

*Stephen Moffat Chepela.*

*"I did not know that from Lusaka there can come words as if the one speaking is just with me in my house and when they are singing as if they were with me in my house. My wife an I are praising the Governor for having sent the District Commissioner walking for 8 miles to come and bring me a wireless set."*

*Chielf Chief Chimbombo.*

*"Oh how very happy we are, I and my wife Lucy. How very pleased we are when our wireless starts to speak at 5 o'clock.*

*Diamon Simukwai.*

*"If you have bad thoughts in you or are fond of fighting others when you get your own set and listen in you can forget and stop all your bad ways . . . Nowadays I will be enjoying a lot if I don't die quickly . . . I wish to tell you that I do enjoy very much listening to my set, although I don't get satisfied as I do when eating 'Nsima' (porridge). If you spend your £6/5/0 in buying a cheap wireless set then you know that it will always keep you happy."*

*I. Webster Kmombo.*

*"At 444 miles away on the Great North Road always people come around me to listen in and are very pleased. Number of them is about 25 to 40 people. So, sir, we are all very happy indeed. I carry my set with me on the mail lorry."*

*E. M. Stephenson (Mail Driver).*

*"With much pleasure to inform you that I have already bought one of the wireless sets which of course make me to be pleased when it is in operation. I bought it as soon as it reached the Booth's store before the Christmas . . . In addition to this many people are also interested to come and listen to my wireless. Schoolboys and girls are very much glad to hear from this machine. We therefore thank the Government of N. Rhodesia for introducing this wonderful machine for the use of the Africans in this Territory."*

*H. A. Chelu (Headmaster).*

# SHORT WAVE NOTES BY RAY SIMPSON

## RADIO SAIGON WITH A NEW NAME

**For many years now listeners have been hearing the Indo-China station in Saigon which was formerly known as "Radio Saigon." In recent months its title has been changed to "Radio France Asie" and one of its frequencies changed from 11.78mc to 11.83mc and also 11.84mc.**

QUITE some time ago now it was announced by the station that they would be carrying out tests on a new channel, 9.524mc. However, despite a careful watch, no sign of this new outlet was heard. It now transpires that they have actually begun to use the 31 metre band but not on 9.524mc, but instead, 9.495mc.

About three weeks ago the writer heard a very powerful French speaking station on this latter frequency which came on the air around 8.15 pm and after playing native type music until 8.30 pm, changed over to Western type music till leaving the air a few minutes before 9.0 pm. The only announcement heard was "Ici Radio Francais Libre" together with the frequency. However, according to Radio Australia, two Southern listeners have identified this newcomer as "Radio France Asie" and heard them testing when they announced they were operating on 9.524mc.

Despite this announcement, they are not on this frequency but as we said before, 9.495mc. On opening and closing they have a distinctive piano interval signal which is easily identified once it has been remembered. We still have a slight doubt that it is actually the same station as Radio France Libre, but agree it is possibly in Saigon.

## RADIO MALAYA

IN a recent letter to one of Radio Australia's DX-ers Calling Session, they said that they had been carrying out considerable testing and that during this period it was quite possible that reception of some of their harmonics had confused listeners.

Considerable expansion of this station is planned both in regard to technical facilities and also programme material and operating times.

Their present operating schedule is as follows but readers will notice that no mention is made of 7.2mc though this channel is still in use, usually in parallel with 7.25mc.

**Red Network.**

6.135mc 2.30 pm to 3.15 pm Indian.
3.15 pm to 4.30 pm Chinese.
4.78mc 7.30 pm to 9.30 pm Indian.
9.30 pm to 11.30 pm Malay.
11.30 pm to 1.30 am Chinese.

**Blue Network.**

7.25mc 2.30 pm to 3.30 pm Malay.
3.30 pm to 4.30 pm English.
7.30 pm to 8.30 pm Burmese.
8.30 pm to 1.30 am English
Sat. 4.30 pm to 7.25 pm English.
7.25 pm to 2.00 am English.
Sun. 11.30 am to 2.30 pm English.
4.30 pm to 7.25 pm English.
7.25 pm to 2.00 am English.

Kuala Lumpur on 6.025mc rebroadcasts the Blue Network of Radio Malaya in addition to local programmes.

## U.S.A. STATIONS CHANGE FREQUENCIES

JUST as we go to press we notice that both the Voice of America stations and the Armed Forces Radio Service stations have made some alterations in frequency.

Voice of America programmes can now be heard from 7.0 pm over KRCA operating on 6.06mc, 9.515mc, and 9.6mc while KCBR is also carrying these programmes on 6.185mc.

The Armed Forces Radio Service have also opened up a channel in the 49 metre band at the same time and can be heard from KCBR using 6.04mc.

## STATION ADDRESSES

**STUTTGART:** Suddeutscher Rundfunk, Radio Stuttgart, 14. Neckarstrasse, Stuttgart, Germany.

**HAMBURG:** Nordwestdeutscher Rundfunk, Rothenbaumchausse 132-134, Hamburg 13, Germany.

**LEIPZIG:** Sender Leipzig, Springerstrasse 24, Leipzig N.22, Germany.

**JANNINA:** 8th Merarchia, Radio Jannina, 492. Taghma Dhiavivasseon, Jannina, Greece.

**CR6RH:** Radio Clube de Huiala, Sa da Bendeira, Lubango, Angola.

**OQ2RC:** Radio Congolia, P.O. Box 63, Leopoldville, Belgian Congo.

**RABAT:** Radio Maroc, Immeuble des P.T.T., Rabat, French Morocco.

**EA9AH:** Radio Tetuan, Calle O'Donnell 11, Tetuan, Spanish Morocco.

**FZK6:** Radio Dakar, Pose Federal de Radio Dakar, Dakar, Senegal.

**YDL:** Radio Indonesia, Studio Padang, Sawahan 51, Padang, Indonesia.

**YDK:** Radio Indonesia, Studio Palembang, Talang Djawa 7, Palembang, Indonesia.

**CFCX:** Canadian Marconi Company, 1231 St. Catherine Street, West Montreal, Quebec, Canada.

**CJCX:** Eastern Broadcasters Ltd., Radio Building, 308 Charlotte St., Sydney, N.S., Canada.

**COBL:** Radio Cadena Suaritos, 25 Num 1113, Habana, Cuba.

**SHORT-WAVE Notes for the December issue are due on November 4. For the January issue they are due on December 9. Please send them direct to Mr. Ray Simpson, 80 Wilga Street, Concord West, NSW.**

## THIS MONTH'S VERIFICATIONS

VERIFICATIONS this month have been few and far between and this seems to have been the case with both the writer and other correspondents who have written. Admittedly there have been a few but all we received were of similar type to those that have already been covered in these pages.

We often think what a wealth of information there would be if all the stations we have written to were to suddenly decide to verify our reports. This can be appreciated when we consider that at the present time the writer has reports away to over 180 stations that so far have not replied, and we know that many other listeners have just as many and maybe more whom they are waiting to hear from.

The only two verifications we will mention this month are Johannesburg on 3.356mc and ZEA Salisbury on 6.018mc. We were particularly pleased to receive the former as we tried for a very long time before we were able to log this low frequency station as this rather high wavelength African is particularly difficult to hear except when conditions are favorable.

The second station, ZEA in Salisbury was heard at reasonably good strength and it was therefore gratifying to receive a nice letter of verification from the Radio Office confirming reception on 15th July last and advising that the frequency in use was actually 6.018mc rather than 6.02mc as we had reported.

## Have You Heard These ?

**PHILIPPINES:** Some months ago now we reported reception of the Manila station DZH6 on 6.03 mc, and later DZH7 on 9.73 mc. When the stations sent along their verification, they stated that they would later take into use DZH8 on 11.855 mc and DZH9 in the 19-metre band. No sign of these stations was heard until quite recently, when DZH8 opened up on 15.3 mc instead of 11.855 mc, as previously advised.

This new one can be heard nightly, but suffers from severe interference from Singapore on the same channel. These stations are all operated by the Far East Broadcasting Co., and the broadcast call is DZAS.

**POLAND:** For some time now we have been hearing a station on 7.205 mc jammed in between GWZ and GWL, around 6.30 am. At first we thought it to be in Yugoslavia, as frequent mention was made of that country, but we have now confirmed that it is Warsaw in Poland. From 6 am till 6.30 am it carries the same programme as Warsaw on 6.215 mc, but from then onward till fadeout, around 7.15 am, it carries a different programme, which seems to be either a news commentary or straight news.

From 6 am, the programme is in French, with both lady and gent announcers, so listeners should have no difficulty in hearing it, provided you can separate from the two London stations.

**MALTA:** The Forces Broadcasting Station in Malta seems to be having great difficulty in finding a suitable outlet for its programmes, as it has recently opened on still another frequency, this time 6.02 mc, which can be heard every morning till station closes at 7 am. This channel is being used in place of the one on 4.965 mc, and carries the same programme as on 7.22 mc.

The latter is much the louder, but the new one on 6.02 mc is quite good, however, except for slight interference from Rome on 6.01 mc. As the programme is all in English, it is quite easy to find and closes with the usual announcement, "This is your Forces Broadcasting Station, Middle East."

**ITALY:** After a few weeks of staying put, so to speak, Rome has again begun experimenting on new frequencies. The latest new one is on 5.98 mc, which is now heard daily from around 6 am. Just prior to opening at the above hour, it has a continuous metronome interval signal, followed by announcement in Italian, "Radio Italiana."

All the programmes we have heard have been in Italian, and are different to the other programmes, being heard on the nearby channel of 6.01 mc. The new one is not particularly loud, and do not mistake HVJ on 5.97 mc for Rome, as the Vatican City transmitter is very strong at the same time, and tends to blot out the 5.98 mc station.

**TANGIER:** In last month's issue, we reported receiving a verification from the Tangier station, EA9AA, which up till that time had been operating on 7.06 mc. Since these notes were written, EA9AA has changed its frequency to 7.12 mc, where it is heard at much better strength. This one can be recognised by its slogan, "Radio Africa," which is given quite often by both lady and gent announcers.

There is another Tangier station on 15.05 mc operated by Pan-American Radio and which is supposed to be on the air from 10 pm to 10.30 pm daily testing out their antennas. We have heard a strange station at the above times, but at time of writing are not certain that it is actually Tangier.

# FLASHES FROM EVERYWHERE

**CAMEROONS:** In the September issue we published a paragraph giving details of Radio Douala's transmissions on 9.15 mc and we now have some further information regarding this station, which we gleaned from Seden Calling DX-ers. According to a letter recently received from the station, in addition to their transmission on 9.15 mc from 3.30 am to 6.30 am, which is with a power of 600 watts, they also have a new 1 kw transmitter in service operating on 7.287 mc and on the air at the same time.

It is their intention to discontinue use of the 600 watt transmitter in the very near future, but whether they will eventually use 9.15 mc or 7.287 mc is not clear.

**GUATEMALA:** From this Central American country we have word of two new stations, the first one being TGNA, which is located in the capital, Guatemala City, and is said to be operating on 6.04 mc, their address being PO Box 601, Guatemala City. Exact operating times are not known, but it is said to close at 1.15 pm. The second one is TGBA, located in Mazatenango and using a frequency of 8.1 mc between the hours of 11 am and 1 pm; 11 pm and 1 am; and 3 am and 5 am.

It is suggested that the best time to try for this one would be from 11 pm onward, but up to the present we have been unable to find a trace of it.

**DENMARK:** Now that the 19-metre band is improving so much at night, we have been able to hear the Danish station OZH at very good strength on 15.165 mc. It is on the air on Tuesdays, Thursdays and Saturdays from 8 pm to 9 pm. On Tuesdays, they have a mailbag session and a DX programme. This frequency is also in use on the same days from 10 am till 11 am, but so far we have not been able to log it at this time.

Copenhagen also is on the air daily from noon till 1 pm in the 31-metre band on 9.52 mc with a programme in Danish. There is also an English programme daily except Monday, from 1 pm to 1.30 pm, so there is ample scope here for everyone to log at least one of these Danish transmissions.

**KENYA:** It is a long time now since we have had any word regarding the Forces Broadcasting Station at Mackinnon Road in Kenya. In fact, the last word was when we received our verification for their 7.175 and 7.22 mc transmissions when they said they were no longer using a short-wave outlet, but were only transmitting in the broadcast band.

We have now heard through the DX session from Radio Australia that this station is again on the short-wave bands, using 6.115 mc at the following times.—Monday to Saturday, 1 pm to 3 pm; 7.30 pm to 9.30 pm; Tuesday to Saturday, 12.01 am to 5 am; Sunday 12.01 am to 6 am, and 3 pm to 5 am Monday. This will be a rather difficult transmission to log, but careful listening may enable you to hear them.

**HUNGARY:** There has been a remarkable improvement in the broadcasts from Radio Budapest, and at the time of writing this station can be heard at really excellent strength from around 6 am. Although they are supposed to be using 11.91 mc, they are only being heard on 6.247 mc and 9.83 mc. This latter outlet is the better of the two, and when they give the news in English, at 7 am, it can be followed word-perfect.

The 6.247 mc transmission is also good, and only slightly less so than 9.83 mc. During the news in English, they ask listeners to send reports of reception giving their comments on the programme and strength of signal, address being simply "Radio Budapest," Hungary.

**GERMANY:** In a recent issue of Sweden Calling DX-ers, they publish a paragraph concerning "Radio Free Europe," which we think may be the same station as we reported recently as heard on 6.13 mc. According to the paragraph we mentioned, Radio Free Europe is operated by "The National Committee for a Free Europe." Programmes are prepared at studios in the Empire State Building, New York, and transmitted by a relay station somewhere in Central Europe.

Transmissions are said to be beamed to all countries under Communist control. Six other transmitters are planned, including some medium-wave outlets. According to another source, the 6.13 mc station is listed as "Radio Europa Libera."

**IRAN:** We hear from Art Cushen that he has verified an Iranian station, EPP, which operated on 4.04 mc, his report being the first received by the station. EPP is now supposed to be operating on 3.94 mc with a power of 2 kw. Other listeners report hearing a station on 6.845 mc with the same programme as EPB on 13.1 mc audible around 6 am, but when reported to the Iranian authorities, they made no mention of the 6.845 mc outlet.

According to our lists, the following are listed for this country: "Persian Forces," 7 mc in Chelman, 7.95 mc in Shiraz, and 6.845 mc in Teheran. In addition, Teheran is assigned to EQD 4.78 mc, EQC 9.66 mc., EQB 6.155 mc, EPF 8.11 mc, and EPB 15.1 mc. There is also an outlet with no call letters on 4.03 mc.

# RADIO AUSTRALIA'S BROADCASTS

While many listeners are well aware of the excellent English programmes given from our own Radio Australia, we think there are quite a number who do not know of the wide nature of this stations transmissions. This station, which was formerly under the control of the Department of Information, has now been taken over by the Australian Broadcasting Commission.

AT first it was thought that this may have meant a curtailment of some of the broadcasts, but judging by the latest schedule just received, it is still providing for listeners in many parts of the world. Some of our less experienced listeners will no doubt have heard Radio Australia in some of their foreign language programmes, but owing to their lack of experience in foreign tongues, may not know that they are actually listening to Shepparton or Lyndhurst stations.

So that these readers can look out for these stations we are printing the full current schedule showing call letters, frequency, times on the air and target area. With the help of this list, we think you will be able to follow these stations without any difficulty, and if you care to write to them they will be pleased to send you a verification card.

| Call | Freq. mc | Mon-Fri. | Sat. | Sun. | Target Area |
|---|---|---|---|---|---|
| VLA8 | 11.76 | 0600-0900 | 0600-0900 | 0600-0915 | British Isles and Europe |
| VLC | 15.20 | 0600-0966 | 0600-0900 | 0600-0915 | British Isles and Europe |
| VLB11 | 15.16 | 0629-0900 | 0629-0900 | 0659-0915 | Japan, N. Pacific Is. |
| VLC | 15.20 | 0900-1050 | 0900-1200 | 0915-1200 | S-E Asia (Malaya) |
| VLA10 | 17.84 | 0915-1050 | 0915-1200 | 0928-1200 | S. and SE Asia (India, Pakistan, Malaya) |
| VLG11 | 15.21 | 1050-1330 | —— | —— | S-E Asia, N-E Australia. |
| VLB5 | 21.54 | 1245-1415 | 1200-1245 | 1200-1415 | Japan, N. Pacific Is. |
| VLC .. | 15.20 | 1245-1415 | 1200 1415 | 1200-1415 | S-E Asia (Malaya). |
| VLA10 | 17.84 | 1245-1430 | 1200-1430 | 1200-1430 | S & S-E Asia (India, Pakistan, Malaya). |
| VLB5 | 21.54 | —— | 1245-1730 | —— | Japan, N. Pacific Is. |
| VLA10 | 17.84 | 1430-1545 | 1430-1545 | 1430-1545 | S & S-E Asia. |
| VLB5 | 21.54 | 1430-1545 | —— | 1430-1545 | Africa. |
| VLC .. | 15.20 | 1430-1545 | 1430-1545 | 1430-1545 | N. America (West Coast) |
| VLA10 | 17.84 | 1545-1655 | 1545-1655 | 1545-1655 | S & S-E Asia. |
| VLG11 | 15.21 | 1600-1640 | 1600-1640 | 1600-1640 | Tahiti. |
| VLC | 12.20 | —— | —— | —— | French Indo-China. |
| VLA10 | 17.84 | 1655-1815 | 1655-1815 | 1655-1815 | British Is., Europe and S. Asia. |
| VLC4 | 15.32 | 1655-1815 | 1655-1815 | 1655-1815 | British Is., Europe and New Zealand. |
| VLB3 . | 11.76 | 1655-1815 | 1655-1815 | 1655-1815 | British Is., Europe and New Zealand. |
| VLG11 | 15.21 | 1700-1730 | (Fri. Only) | | Trailand. |
| VLG11 | 15.21 | 1745-1845 | 1745-1845 | 1745-1845 | New Caledonia. |
| VLA6 | 15.20 | 1828-2130 | 1828-2130 | 1828-2130 | Japan, N. Pacific Is. |
| VLB4 | 11.85 | 1828-1950 | 1828-1950 | 1828-1950 | N. Asia, Japan. |
| VLC4 | 15.32 | 1828-2030 | 1828-2030 | 1828-2030 | S and S-E Asia. |
| VLB4 | 11.85 | 2000-2130 | 2000-2130 | 2000-2130 | S-E Asia. |
| VLC4 | 15.32 | 2030-2100 | 2030-2100 | 2030-2100 | Indonesia. |
| VLC4 | 15.32 | 2100-2130 | 2100-2130 | 2100-2130 | S and S-E Asia. |
| VLA5 | 15.20 | 2130-2355 | 2130-2355 | 2130-2355 | Japan, N. Pacific Is. |
| VLB4 | 11.85 | 2130-0000 | 2130-0000 | 2130-0000 | S. and S-E Asia. |
| VLC4 | 15.32 | 2200-0000 | 2200-0000 | 2200-0000 | N. America (East Coast). |
| VLA6 | 15.20 | 0000-0100 | 0000-0100 | 0000-0100 | British Isles, Europe. |
| VLB4 | 11.85 | 0000-0100 | 0000-0100 | 0000-0100 | S. and S-E Asia. |
| VLC4 | 15.32 | 0000-0100 | 0000-0100 | 0000-0100 | N. America (Central). |
| VLB4 | 11.85 | 0100-0215 | 0100-0215 | 0100-0215 | S. and S-E Asia. |
| VLC4 | 15.32 | 0100-0215 | 0100-0215 | 0100-0215 | N. America (West Coast). |
| VLA4 | 11.77 | 0115-0215 | 0115-0215 | 0115-0215 | Africa. |
| VLG11 | 15.21 | 1050-1330 | —— | —— | S-E Asia, N-W Australia. |
| VLG11 | 15.21 | 1050-1545 | —— | —— | New Guinea. |
| VLG11 | 15.21 | 1600-1640 | 1600-1640 | 1600-1640 | Tahiti. |
| VLG11 | 15.21 | 1700-1730 | (Fri. Only) | | Thailand. |
| VLG11 | 15.21 | 1745-1845 | 1745-1845 | 1745-1845 | New Caledonia. |
| VLG10 | 11.76 | 1859-2330 | 1859-2330 | 1859-2330 | New Guinea. |

## NEW STATION LOGGINGS

| Call | Kc | Metres | Location. | Times Heard. |
|---|---|---|---|---|
| ROME | 5980 | 50.17 | Rome, Italy. | 6.30 am. |
| F.B.S. | 6020 | 49.83 | Malta. | 6.30 am. |
| KCBR | 6040 | 49.67 | Delano, Cal. U.S.A. | 7.00 pm. |
| TGNA | 6040 | 49.67 | Guatemala City, Guatemala. | 1.00 pm. |
| KRCA2 | 6060 | 49.50 | Dixon, Cal. U.S.A. | 7.0 pm. |
| F.B.S. | 6115 | 49.06 | Mackinnon Road, Kenya. | 5.00 am. |
| KCBR | 6185 | 48.50 | Delano, Cal. U.S.A. | 7.00 pm. |
| EA9AA | 7120 | 42.13 | Tangiers, Tangier. | 7.00 am. |
| SP41 | 7205 | 41.63 | Warsaw, Poland. | 6.00 am. |
| HRXW | 8982 | 33.40 | Tegucigalpa, Honduras. | 8.00 am. |
| DZ12 | 9550 | 31.41 | Manila, Philippines. | 9.00 pm. |
| KRCA | 9600 | 31.25 | Dixon, Cal. U.S.A. | 7.00 pm. |
| KHANIA | 10050 | 29.86 | Khania, Crete. | 6.00 am. |
| DZH8 | 15300 | 19.61 | Manila, Philippines. | 8.00 pm. |

# THE HAM BANDS WITH BILL MOORE

**Since the war radio amateurs have been gradually extending the range of their transmissions on the UHF bands. A greater knowledge of propagation on these frequencies gained by recent experience has assisted, as have improvements in antenna design and increased power.**

)ISTANCES now covered are greatly in excess of anything anticipated a w years ago.

Distance records on the 144mc band ere shattered during late September id the record now stands at 1300 miles. 2BAV was responsible for the good ork and he worked two W5's at that stance, as well as a W0 at 1175 miles.

The latter was using only 12 watts in- it but W2BAV uses a 48 element beam that would help. Incidentally he runs 0 watts input on 144mc. It was thought iat the signals were reflected and that opospheric bending was not respon- ble for the conditions.

## HIGH POWER

The general trend in the US is to- ards high power on 144 mc/s and many mateurs are running a full KW on this and. W4AO of Virginia increased power 1KW from 100 watts and trebled his round wave coverage. He has no trouble n working consistently over 100 miles ven under bad conditions. He has worked considerable number of stations etween 700 and 900 miles during aurora isturbances.

Pointing the beam north during the urora, signals are reflected back to nany portions of the States. W4AO uses 32 element beam horizontally polar- sed, plus a 10 element reversible array.

During September, NSW amateurs stablished a new 576mc band record or the State. VK2ABH, 2WJ, 2VW and LY operating from Blackheath in the Blue Mountains established contact with VK2AKC station of the Kingsford Radio Club in Sydney. The distance covered was 55 miles.

The portable transmitter consisted of PP RL18's self excited, and the receiver a 955 super regenerative detector and audio stage. The antenna a 24 element array.

It looks as if 50mc will soon provide some of the anticipated seasonal DX. In early October during the day a num- ber of carriers have been heard fading badly and coming from the North East. They were possibly KH6's or W's.

## MAKE USE OF WWV

AMATEURS use the standard frequency transmissions of the U.S. Bureau of Standards so often that the following information on WWV may be of interest.

The station is located at Maryland, 20 miles north of Washington DC and the frequency of the transmission is held constant by one of three vacuum mounted quartz crystals which run continuously on 100kc/s.

These crystals are located in a concrete vault 30 feet in the ground and each is encased in an insulated temperature con- trolled box.

The vault is seldom opened, as the heat from a human body is sufficient to effect a noticeable change in temper- ature and frequency of the crystals. The crystal which is holding its frequency most accurately, is used to control the standard frequency transmissions at any given time.

The transmissions from WWV are accurate in the Broadcast Band to one part in 50 million or point 000,002 per cent. The maximum deviation allowed by the F.C.C. from allocated frequency in that band is 20 cycles or point 02 per cent.

As the frequency is multiplied, the margin of error increases but even at 35,000kc/s accuracy is still better than a cycle. As well as controlling the fre- quency of the transmissions from 2.5 to 35 megacycles, the original 100kc signal is divided to control the 440 and 1000 cycle tones and even runs a 50 cycle clock.

The second "beeps" that can be heard imposed on the transmissions is a 1000 cycle tone that lasts for 5/1000 of a second. The standard 440 cycle tone is also transmitted for given periods.

## OVERSEAS COMMENT

THE Clapp Oscillator is in the news again, not with reference to its virtues as a VFO, but in regard to its origin.

You will remember that information on the Clapp appeared in QST in 1948 (originally in the I.R.E. proceedings). Later the Technical Editor, George Grammer, W1DF, pointed out in reality the circuit appeared in QST back in 1941.

A new claimant as the originator is B.B.C. Engineer G. G Gouriet. He states that he first used the circuit in 1941 and it has been used practically exclusively in B.B.C. equipment since that date. We are mainly interested in its efficient operation and whoever did invent it, is to be congratulated.

The RSGB celebrated this year the 25th Anniversary of the publication of their official journal the R.S.G.B. Bulletin. From a circulation of 1000 in 1925 it has now increased to 14,000. Since the war the society has had great dif- ficulty in obtaining sufficient paper to keep the journal at a reasonable size. The position has improved slightly and the Bulletin now runs to 40 pages per month.

The magazine is available to members free of charge and membership costs 12/6 sterling. Special attention is paid in its pages to TVI-free equipment and one can keep abreast of technical develop- ment in amateur affairs in Great Britain by perusing its pages.

The G's are certainly in some diffi- culty over the erection of their towers and beams in many areas. Both G8QW and G2AK have been refused permission to erect towers for supporting their rotary arrays.

Both these amateurs first struck trouble when their respective local councils would not grant an authority for the building of towers. Appeals were then made to the final authority, the Ministry of Town and Country Planning, and these were also rejected.

The Ministry gave as its reason, that this proposed development, would be in- consistent with the proper planning of the area.

Representatives of the RSGB were in attendance at both appeals and further investigations are being made in the hope of overcoming the position as it now stands.

## BLIND AMATEURS

Radio Technical Education of the blind is receiving much more attention in recent years and Bill Zech VK2ACP of Katoomba is obtaining from the USA copies of a Radio and Electronics Guide published monthly in Braille. This maga- zine is edited by W2JIO. In England con- siderable use is made of the Talking Book scheme, where quite a number of technical books have been recorded. The RSGB has proposed that a talking book version of the Amateur Radio Handbook be produced, and that they would be glad to contribute to the cost of such work.

Sir Ian Fraser, well-known authority on matters pertaining to the education of the blind, offers the suggestion that radio amateurs could assist greatly if they would give information on the operation of the Talking Book Machines to blinded persons.

Quite a number of these machines are returned to the National Institute for the Blind as unserviceable, when a small adjustment would make them work again.

Sir Ian, a past president of the RSGB, who is blind himself, considers that radio amateurs could assist greatly if they would keep an eye on Talking Book Machines in their locality, and assure that machines are only returned to the Institute when they are in need of a major overhaul.

Recently in England, the call sign G3GYL was issued to Miss Nina Barrett who has the misfortune to be blind. In a short twelve months Miss Barrett mastered the Morse code and took aurally the same technical examination as did other candidates for the amateur licence. G3GYL only operates on 3.5mc CW at the moment.

Considerable investigations is going on at all times to improve the usefulness and accuracy of the service. In the latter case efforts are being made to better the standards in the UHF spectrum.

With the ever increasing number of television stations in the U.S. it has been necessary to operate stations on the same frequency. If station frequencies can be controlled extremely accurately simul- taneous transmissions can be made from stations in close proximity. At the moment this is impossible due to the lack of standards in the spectrum.

## CERTIFICATE DESIGNS

THE Federal Executive of the WIA has invited new designs for the Aus- tralian DXCC certificates, and it is hoped that the amateurs who were not happy about the old one will submit their own design.

The NSW WIA combined Newcastle and Sydney Field Day will be held at Woy Woy on November 26th. Assembly will be at 11 am at the usual point, the Masonic Hall, and a full programme has been arranged. The hidden transmitter search will be run on 144mc (horizon- tally polarised) and 3.5mc. No special arrangements have been made for meals but light refreshments will be available.

Cec Hardman, VK2KR of Woy Woy, will be pleased to hear from anyone who can attend and the local gang at Gosford and Woy Woy have been meeting on 50mc to discuss details for the Field Day.

Reports on the special amateur band predictions and charts presented monthly in the WIA magazine Amateur Radio are earnestly required. These charts without a doubt are being used exten- sively and it is desired to learn how they work out in practice.

Comments on the usefulness of these charts should be forwarded to the WIA.

The NSW Division's UHF section opened the UHF summer season with a 144mc contest run between October 13th and 28th. Support during the opening days was excellent.

Dr. Allison VK1RA at the September meeting of the NSW Division presented three films of Life on Heard and Mac- quarie islands and the Antarctic. The doctor explained many phases of life down under and the evening was very entertaining, attracting the largest crowd at a monthly meeting for many months.

## THE VK/ZL CONTEST

The VK/ZL DX Contest started off under very bad conditions and by 0100 hours on the first evening many amateurs who would normally operate throughout the night, had retired. The contest re- ceived good support but amateurs every- where complained of the poor conditions.

Bill Leonard W2SKE reviewing the contest over the Voice of America claimed that Australian signals were rather poor but the 7mc provided the best possibilities for consistent working. Quite a number of contacts were made

with American stations on 3.5mc/s. Scoring well in NSW in the CW section were VK2GW, 2EO, 2GG, 2ZC and 2AHA.

Following the original experiments on influence of the ionosphere conducted by Professor Bailey of the Division of Physics Sydney University further tests were made between 0100 and 0200 hrs on October 4th and 11th. Amateurs in the Blue Mountains and the Goulburn area forwarded reports. National Station 4QR on 580kc/s was again used and the pulse transmission was made from the New England College of the University. Reports forwarded by amateurs on the original experiments according to Professor Bailey were valuable and greatly appreciated.

The NSW division has decided to run a hamfest in conjunction with the National Field Day to be held in January. At the meeting to organise the day were past presidents Frank Goyen VK2UX, Wal Ryan VK2TI, Morrie Meyers VK2VN, and a full and comprehensive programme is to be arranged. Tentative details are as follows—the hamfest will open on the Friday evening when a special monthly meeting will be held. Saturday afternoon will see competitions and lectures presented, and in the evening a dinner will be held. On Sunday, special prizes will be presented to parties operating in the National Field Day and it is anticipated that many stations will be in the field.

## DX AND PERSONAL

DX of the month was perhaps FB8ZZ operating from Isle Nouvelle Amsterdam in Antarctica. On 14040kc/s he appeared around 2100 hrs E.A.S.T.

VK5BY managed to contact him but within 10 minutes of his appearance he was receiving the attention of the usual group of W stations. It was a typical September evening on 14mc—hardly a DX station breaking through, certainly no W stations.

The FB certainly brought W3BES, 3CPV and 2AUQ plus a hundreds out of hiding. Even VP7NM, rare as he may be, was unable to compete with the S9 Americans. If they are only using a KW then some of their beams must have a gain of 40 DB., considering the fact they can produce an S9 signal on a "dead" band.

Jack Young VK2OY of Goulburn must really be putting a good signal into the US. He received special mention in a Voice of America Broadcast as being the loudest Australian on the East Coast—"like a local" was the exact term used.

FKS is the prefix used by French troops in Austria, while most of the Italians have made a change and are now signing IT instead of the old I prefix. An odd Frenchman can be heard signing stroke FC and is located in Corsica.

VQ8CB in the Chagos Islands is on again, and appears between 2100 and 2200 hours E.A.S.T. on 14030. He is rather weak as he is only using low power, but can be contacted.

Just to show that the lower frequency bands are still good, Hugh Stitt VK2WH contacted a W6 and W7 on 3.5mc telephony at 2330 hours E.A.S.T.

South Africans are again coming through in the late evenings, ZS5U has been heard as early as 2030 hours which is about a record for 14mc working.

Two old-timers joined the ranks of "Silent Keys" during September—KZ5PA and Bill Hall ZL2BH.

KZ5PA, active from the Canal Zone for many years, is best remembered as NY2AB in the thirties, while Bill was active on all bands throughout the years. Many Australians remember ZL2BH for pleasant 80 metre yarns in the last few years.

PK5AA 14060kc/s is active most evenings, and is rather popular as Dutch Borneo is still a rare country. HC2IS caused some excitement on 7mc/s as South Americans are pretty scarce on that band. Quite a number of Australians took the opportunity of making a WAC.

# Why do things happen?

(Continued from Page 15).

per downward? No, the paper came

So likewise does it happen to an roplane wing. It was discovered it the upward curve of an aeroplane ng forced the air caused by the rward motion of the plane to travel a higher speed over the top of the ng than on the comparatively flat rface underneath. This caused a re- iced pressure on the top because of e increase of velocity and accounts r three-quarters of the lift. This reduced pressure may not ac- unt for much per square inch, being it is perhaps only a couple of inces lower per square inch than nderneath. But multiply this by the ousands of square inches of a ane's wing surface and the result a lift amounting to some tons.

## IR PRESSURE

While we are on the effects of air ction, it is well to finalise this dis- ussion by dealing a little with air ressure.

Air pressure is responsible for the ction which we commonly call suck- ng.

When we refer to sucking liquids p a tube we really mean that we educe the air pressure at the top of tube and the higher atmospheric ressure on the surface of the liquid orces the liquid up the tube.

Those familiar suckers used for at- aching sun visors to windscreens or lass table tops to counters, &c., rely n this pressure for their action. When you press one of these suckers n a smooth surface you force all he air from between the sucker and he smooth surface. The atmosphere ressing on the outside surface of he sucker at 15 pounds per square nch makes it difficult to pull the ucker off.

Finally, you can easily demonstrate why streamlining of cars, aeroplanes and ships is necessary and how it works. Light a candle and hold a flat piece of cardboard between the flame and your mouth. Blow on the card- board. The flames comes toward you.

Now bend a piece of cardboard about four inches wide and a foot long into the shape of a blunt-nosed boat, with the rear end tapering off to a point. Place this between the candle flame and your mouth and blow on the blunt end. The candle flame goes away from you.

## "DRAG"

There is a popular idea afoot that the resistance of air or water to a car, plane or boat is caused by the water or air that hits the front end. This is not right. It is caused by the air or water being torn from the latter end.

The above cardboard and candle demonstation proves this. In the case of the flat cardboard the air can't flow smoothly past the cardboard, but rushes around and past the edges and creates a partial vacuum at the back. The flame is therefore suck- ed or, more correctly, pushed toward the cardboard by the air behind it coming in to fill the partial vacuum.

This disturbance of air at the rear of a plane or car or of the water at the rear of a boat causes most of what is called "drag." So that blunting the front ends of the vehicles and sharp- ening the rear end reduce these eddy currents to a minimum.

So our discourse is at an end. It is to be hoped that I have given some idea of how to go about making science easy. There are many more angles of physics which can be dealt with in this manner and I hope to do so in future articles.

# A COURSE IN TELEVISION

(Continued from Page 59)

the cathode circuit and produced by the pulses of plate current.

When the signal is first applied to the valve, the plate current builds up a voltage in the cathode circuit which is "averaged out" and held constant by the long time constant of R and C. Thereafter, plate current flows only during the high amplitude synchronising pulses, which are suf- ficient to overcome the standing cathode bias.

Once again, great care is necessary in selecting the values for R and C and also a high Gm. tube which generates high plate current pulses for moderate input signals.

The diode versions of these two cir- cuits are shown in figures 3c and 3d.

In figure 3c, the components R and C are given a time constant long enough to hold the diode plate sub- stantially negative and therefore pre- vent plate current flow except on the positive peaks of signal. On these positive peaks, however, a voltage appears across the cathode load re- sistor RL, while the corresponding current through "R" helps to main- tain the charge across "C" at a figure approximating the black or blank- ing level.

In figure 3d both loads are in the cathode circuit. Here R and C com- bine to hold the cathode initially positive, the synchronising pulses ap- pearing across RL.

## DIODE SEPARATORS

Diode separators are less sensitive than triodes or pentodes, for obvious reasons, but there are cases where they may be more convenient. The pulses produced by the diode arrangement of figures 3c and 3d are positive-going, while those from the plate of an amplifier valve, as in 3a and 3b are negative-going.

The matter of pulse palarity is important, in that most pulse gener- ators are triggered by positive-going pulses. Therefore, the sense of the synch. separator and the number of possible synch. amplifiers must be arranged to maintain a positive-going signal to trigger the oscillators.

Thus far, synch. separation has been considered as a function quite separate from detection and d-c restoration—subjects which have al- ready been covered in these columns.

In practice, however, the functions of synch. separation and d-c restor- ation are frequently combined, oper- ating in conjunction with the final video amplifier. While it is not possible to examine all likely com- binations, one simple circuit will serve to illustrate the idea.

In figure 4, V1 is the final compen- sated video amplifier, delivering its signal to the picture tube through the coupling condenser Cc. From the connection of the diode, the signal is obviously so phased that the synch. pulses will be negative-going.

The action of the diode tends to line up these negative peaks, thereby having the desired d-c restoration effect on the signal applied to the picture tube grid. The signal pulses representing white are then positive going with respect to this reference, which is according to requirements.

At the same time, the negative pulses applied to the cathode produce a burst of current through the diode, allowing the synchronising signals to appear across the resistor in the plate load.

## LIMITATIONS

Circuits of this nature, although manifestly simple, suffer from vari- ous limitations. Not the least serious is the effect of normal variations in line voltage, which change both the gain of the stages feeding the separ- ator and the marginal voltages which govern its operation. The separation of synch. and picture signals is there- fore likely to be erratic, while the shape of the pulse may depart sub- stantially from the desired rect- angular form.

The tendency is for pulse require- ments to become more stringent as the frequency increases so that cir- cuitry which is adequate for medium definition systems is a virtual failure for high definition. As a result, it is not unusual to find voltage stabi- lising and wave shaping circuits to improve the contours and the con- sistency of the pulses.

It will be recalled that a com- posite signal contains timing pulses for both the vertical and horizontal sweep oscillators, the difference being in their spacing and duration. A problem which yet remains is to separate the pulse trains so that the resultant voltages can be applied to the respective oscillators.

# GERMANIUM INFRARED LENSES

A TECHNIQUE of purifying ger- manium, the chemical from which lenses for spectacularly improved infrared equipment can be made, was announced in Oak Ridge, Tenn.

Lenses made from germanium transmit invisible heat radiation. The germanium lenses will do this even though they are an inch thick and do not allow ordinary light to pass.

# OFF THE RECORD — NEWS & REVIEWS

**The history of reproduced sound and how to get it has been an interesting one, none the less because of the prevailing "fashions" which from time to time have come and gone in the attempt to pin-point the most important factor in getting results. The importance of power output, transient response, and frequency response, have all been focal points of discussion in their day, each being the subject of much measurement and experiment.**

By JOHN MOYLE

AT the moment, the emphasis seems to be on intermodulation distortion, that rather elusive thing which is perhaps the hardest of them all to isolate and evaluate.

The word fashion isn't really a good one, because it might be considered to imply that none of the things are really important, but are simply fads which sound engineers fasten on from time to time.

The fact is they are all extremely important in their own way, as most of us have found from time to time. But the answer is really that they all bear on the same thing, and in some cases, are merely different ways of attacking a problem of clean reproduction which is vitally affected by them all.

This intermodulation distortion can be explained quite simply as it concerns its simple forms. If for instance we play two different frequencies through an amplifying system, but insert in the output a filter which removes one of them, we should hear only the unfiltered note through the speaker. If intermodulation distortion is present, however, we will hear the untouched frequency all right, but super-imposed upon it we will hear more or less of the second frequency which "rides in" on the first.

I think it will be fairly obvious that, if this effect can be noticed in such a simple case, it indicates that although an amplifying system may be fine when tested on single notes, it will be subject to more or less severe distortion when reproducing music which demands a wave form often exceedingly complex.

## TECHNICIAN'S PARADISE

The subject is something of a technician's paradise, and it is not my idea here to blind you with science by treating it as such. Its effect on the listener is to make clear separation of musical instruments, for instance, almost impossible, because they are always distorted by an admixture of other frequencies which originate in other instruments. It is one reason why orchestral records, for instance, sound confused and muddy on one speaker, but much cleaner on another.

The prime cause of intermodulation distortion in any amplifying system in non-linearity. This term may be explained by saying that a linear device is one in which the ratio between the magnitude of the input and the output is constant. It could be represented graphically as a straight line, and often it is. If this line shows any curvature over that portion which is used when the amplifier is operating, then it indicates non-linearity in that particular stage or device.

## NON-LINEARITY

Now the opportunities for non-linearity in an amplifier are many, and, of course, must include the pick-up and the loudspeaker as well. This means that both electrical and mechanical non-linearity are concerned, for record reproduction involves the translation of mechanical energy into electrical energy, and back again to mechanical energy, a process which has already taken place at the record factory before the record ever reaches your turntable!

At the factory, however, there is generally an adequate supply of high grade equipment and facilities for checking linearity which are denied to most amplifier builders. So we can be fairly sure that what intermodulation troubles do exist in good modern records, they are quite

w in value as compared with what e might produce at our end.

Coming now to the things we can o to reduce intermodulation the rst is the selection of a good pick-o. It's rather hard to say more ian this, because intermodulation gures are rarely quoted for pick-os, and in any case are likely to ary from one sample to another ccording to accuracy in manufac-ure.

Possibly the most important thing n the pick-up is that the armature nould move in a constant magnetic eld. This means a not too narrow ap, accurately placed armature, and ne which moves over a small arc. n other words, if we consider the ick-up as a small electric generator, ts electrical output must vary in lirect and linear ratio with the novement of the armature, within ts limits of amplitude.

## AMPLITUDE

This last qualification is quite im-ortant, because it appears all along he line of reproduction. It is fairly easy to preserve linearity at low mplitudes or volumes, but when extremely high amplitudes are in-volved, and the armature of neces-ity approaches closer to the pole pieces, it operates in a much more ntense magnetic field, and its out-put at that instance increases. In other words, we no longer have a linear relationship between arma-ture movement and electrical out-put.

To a certain extent, this explains why some pickups will play loud, musically complex passages more cleanly than will others, while both are able to do a good job in quieter passages where the movement of the armature is not so great. In fact, it is probably true that the non-linear chain commences with the in-timacy of the stylus tip contact with the record. This, of course, should be constant at all amplitudes, but I fear that only the best of the new light-weights, with their high compliances, approach this ideal.

Leaving the pickup, we come to the amplifier itself. Here our main con-sideration will be the valves. They are the actual amplifiers, and, to-day are used almost exclusively with wide-range resistance coupled stages.

## THE VALVES

Now, non-linearity, even though it is in small doses, is a natural enemy of the valve. Most valves in gramophone amplifiers operate as voltage amplifiers, that is, they are fed with certain voltages in the grid circuit, and produce amplified ver-sions of these voltages in the plate circuits. And here's the catch — these input and output voltages must be in direct or linear ratio if inter-modulation is to be beaten.

The valves used are adjusted in such a way that they operate as class A amplifiers. The grid bias is so adjusted that the valve will accept a certain grid voltage and amplify it with good linearity. As soon as the input voltage exceeds a permissible figure, however, this linearity deter-iorates very rapidly.

The obvious precaution, therefore, is to see that there is always a good margin of safety in the voltage handling capacity of the valves used in all stages. In practice, this should be something like 50 per cent. It is one reason why it is good prac-tice to use high powered output valves, which are never pushed near their output limits.

The intermodulation distortion of an amplifier at half power may quite well be very low — only a few per cent — rising to a completely un-acceptable level when approaching the limit of its rating.

## LOUDSPEAKER

The same general story is true of a loudspeaker. Here, we have an electric motor which must produce output in direct ratio to input. As in the case of the pickup, we have a magnetic field with a moving com-ponent — this time, the voice coil. This coil must operate in a con-stant magnetic field for linearity. If it is energised to such an extent that the coil itself, moves to the weaker sections of the magnetic field round the gap, non-linearity is in-evitable.

Speakers, therefore, should have a deep magnetic gap and a big magnet to hold up the lines of force if the voice coil is to sustain move-ment of large amplitude and stay in a constant magnetic field.

The alternative, of course, is to operate a speaker at well below its maximum level. Irrespective of de-sign, this is a really good practice, and one of the most effective in avoiding intermodulation.

Operation well within limits also makes the task easier for the actual loudspeaker cone. Unless this is completely rigid, it is bound to break up in some way when asked to handle complex oscillations at high ampli-tude.

## SUMMARY

When we realise the almost end-less chain of electrical and mechani-cal operations which interpose be-tween the original performer and the reproduced sound, we might well marvel that the finished product sounds half so good. But it will sound better without intermodula-tion distortion, and, if you can't do much about the design of your pick-up or your loudspeaker, at least you can see that your amplifier is de-signed to handle the volume you re-quire without overload, and, in fact, to operate well within its maximum capability.

There I'll have to leave this sub-ject for the time being, although there are many other aspects I'd like to discuss. Some of them are rather hard to handle in a general way without getting off the track, but they have a big bearing on our approach to good sound.

Incidentally, quite a few relevant points on distortion have come up in the "Buy An Argument" series of articles. Amplifiers are under dis-cussion right now, and you might get some interesting angles from reading our readers' letters and the technical editor's replies.

# SIMPLIFIED UAL WAVE SET

(Continued from Page 35)

ed coils for the benefit of those o happen to have such a kit.

We will assume that you do not e a modulated oscillator. In any e, constructors with such an in- ument will, no doubt, be familiar h the procedure. Quite a good of alignment can be done on adcast stations if due care is en.

Remember that the receiver is ipped with AVC and if you at- npt to do the alignment on strong al stations the effect of any ad- tment will be masked to some tent.

However, the AVC circuit is ar- ged so that it has a slight voltage lay characteristic and does not me into operation until a definite nal level is reached. Therefore, suggest that you carry out the gnment procedure, or, rather, the al touching-up, on weak but steady gnals such as can be expected from tant stations during daylight hours.

## NING UP

After allowing the set to warm up r five minutes or so, tune in a sta- on toward the high-frequency end the band and adjust the aerial immer for maximum output.

Next, tune to a station at the low- equency end of the band and adjust e padder until you receive it at aximum volume. Adjustment of the dder will affect the position of the ation on the dial, so that it will be ecessary to retune each time. With e chassis standing on its end, you ould be able to juggle the padder nd dial until you obtain the strong- st signal.

Having obtained a satisfactory ad- ustment of the padder, loosen the rubscrew holding the dial drum to e condenser shaft and turn the rum as necessary to make the sta- ions near the low-frequency end of he band correspond with the dial alibrations.

Then tune to a station near the igh-frequency end of the band and djust the oscillator trimmer until he dial calibration is correct. Peak he signal, or preferably a weak ignal nearby, with the aerial trim- ner. The alignment of the front-end ircuits of the receiver is then com- lete, but if you are fussy you could epeat the whole procedure.

## .F. COILS

Up to date, the variable slugs in he IF transformers should not have een touched. They are set to the orrect frequency during the normal esting procedure at the factory, but ircuit capacities will change the set- ings somewhat, and it is necessary hat they be readjusted.

Tune to a weak but steady station nywhere on the dial, and carefully djust the slugs one by one for maxi- num output. However, it is a good dea to carefully note the original ettings in case you have to return to hem for some reason. This completes he broadcast alignment.

If your coil unit is fitted with variable iron dust cores the procedure is slightly different. Begin by adjusting the aerial trimmer at the high-frequency end of the band but at the low-frequency end of the band adjust the aerial coil slug for maximum output. Note that there is no necessity to rock the dial backwards and forwards to make this adjustment. The oscillator coil core is set at the factory and should not be interfered with.

Loosen the dial drum screws to make the stations correspond with the dial, retune to the high-frequency end of the band and correct the calibration with the oscillator trimmer.

## S.W. BAND

It now remains to check the alignment in the shortwave position. Do not be disappointed if when you first switch in the shortwave coils you hear only a few weak signals. Conditions on the shortwave bands are subject to great change, according to the time of day and time of year. Ray Simpson's shortwave notes in recent issues will act as a guide as to the best stations, frequencies and transmission times.

If you dual-wave unit has air-cored coils there will normally be only two adjustments to worry about on the shortwave band. The padder capacitance value is not as critical as on the broadcast band and an adjustable padder is not required.

Start with both trimmers about halfway in, and tune in a station toward the high-frequency end of the band. Then peak the aerial trimmer. You may find that the aerial trimmer has a very slight effect on the dial-setting, so it is a good idea to retune after each adjustment.

The dial calibration can be adjusted with the oscillator trimmer, but remember to readjust the aerial trimmer after each change in calibration. Actually you may have to do a certain amount of listening before you can identify a station positively and obtain its exact frequency.

With iron-cored shortwave coils, adjust the aerial slug for maximum output at the low-frequency end of the band and return to the high-frequency end and recheck the aerial trimmer at the high-frequency end. Calibration can be connected with the oscillator trimmer, in which case the aerial trimmer must be readjusted.

# TRANSMITTER FOR 50 MC

(Continued from Page 45)

be mounted with connecting leads as short as possible, and preferably with the coil actually mounted on the condenser itself.

Assuming about 5 mills or more drive for the 807's, the last problem is that of instability in the final stage.

In the grid circuits, we have used a couple of parasitic chokes, just on principle, but in fact they were quite unnecessary.

It is almost impossible to avoid some regeneration in this stage, because the 807 internal capacitances and lead inductances are not low enough to avoid it at 50 mc. They should not be enough to cause oscillation of the stage, however, unless we add to their effect by not reducing external, unwanted capacitances and inductances coupling to a minimum.

## STABILITY

In keeping the stage stable, therefore, there are two important points to be watched.

The first is that both cathodes should be well and truly earthed, and the second is that the screens should be individually bypassed right at their sockets.

The effect of the screen circuit on stability is a subject on its own, too large to analyse here. However, by a process of progressive experiment, the aim of which was to obtain the least possible grid current variation as the plate circuit was tuned to resonance, we found that cathodes individually earthed to the metal shield, and mica bypasses at each screen, not only produced this state of affairs, but prevented any tendency of the output stage to oscillate with or without load, and with or without drive. Some regeneration exists, but not enough to seriously prejudice operation or adjustment.

In fact, by individual cathode bypassing, we were able to include a 200 ohm cathode resistor for use when tuning up to avoid excessive plate and screen currents, but which is switched out when the transmitter is in use. This is a convenience, but a rather useful one if the voltage is more than about 400.

Better than mica condensers would be the special ceramic types now available, which are small, allow short leads and virtually eliminate condenser inductance—quite important at 50 mc, and which limits the value of even mica condensers as bypasses.

There is nothing much more in the transmitter, which is not shown in the circuit and pictures. Although the meter is switched to read the plate current of the 6V6's, it is the grid current of the 807's which is really the most valuable check on their operation.

Do not operate the 807's for more than a few seconds at a time without a load, as the screen current may rise to a dangerous figure if you do. When testing, use a 60-watt lamp as a dummy load.

We used two power supplies—one to give about 350 volts for the 6V6's, and another to give 600 volts for the final.

One supply could be used, however, selecting dropping resistor values to give the right voltage distribution.

A standard 807 class AB2 modulator will be ideal to modulate this transmitter. With 600 volts available, it will produce plenty of output when loaded to about 160 mills plate current.

# A PRACTICAL BOOK ON AMPLIFIERS

**We have read many textbooks on amplifiers—probably as much has been written about sound reproduction as any other aspect of radio. And because there is always the unknown quantity of personal likes and dislikes involved, there is always room for argument.**

IT was therefore with much relief and not a little amusement that we looked through a copy of HIGH FIDELITY TECHNIQUES, written by James R. Langham, and published in USA by Hugo Gernsback for one dollar.

Inside the space of 100 pages pretty well the whole business of getting good sound is covered from A to Z, commencing with a general discussion about distortion, running through speakers and baffles, continuing via amplifier circuit design to conclude with much useful and practical comment on records and pickups.

What we liked about this book was its free and easy approach—its appreciation of the fundamentals and many finer points, and its expression of them in understandable terms.

Witness this extract from the foreword, which is typically titled "About This Book." "There is no such thing as an audio engineer. The trouble is that its all subjective. It's not cut and dried . . . Nobody has the right to dictate what you should like. If you happen to want a lot of bass — why fine — nothing in the world wrong with listening to it. If Major Armstrong builds a gorgeous hunk of set that your neighbor likes you are perfectly within your rights if you think it stinks. High fidelity audio is a nebulous thing and unpredictable beyond a certain point."

Now don't get the idea that the book can be dismissed because it's written that way. The point is that although it is packed with practical facts, it makes at the same time really entertaining reading. So much so that, once having got started, we began reading from cover to cover with no great urge to put it down while we digested a set of curves and equations. There are plenty of useful curves and circuits, but very few equations, and no superfluous ones.

The author is obviously a well informed man who has done plenty of building. He has told his story as he would tell it to a couple of interested friends over the lunch table with illustrations scrawled on the menu. Maybe that's why most people will be able to understand it.

Whether we would agree with all the ideas expressed isn't as important as the fact that they all represent a point of view with plenty of legitimate thought behind it.

We suggest you keep your eyes open for this little book. Whether it is talking about "boom boxes" (vented enclosures to you) or "R'n Gm and Stuff," it will be well worth the price.

# ANSWERS TO CORRESPONDENTS

**R.L. (Nangiloc, Vic.)** suggests that we ould describe a 32-volt receiver capable f sufficient power to use as a radiogram.

A.: By this time you will doubtless ave seen the October issue which con-ins details of a set exactly along the nes you suggest. Best of luck if you ttempt to build it.

**K.E.S. (Murtoa, Vic.)** has built up the Vibragram Seven" receiver with good esults but wants to know whether it ould be worthwhile to add an 8-inch nd a 5-inch speaker to the present 2-inch unit to make up a three-speaker ystem "similar to that used in the big -c radiograms."

A.: No, K.E.S., we do not think the xpense would be warranted. The acous-ic efficiency of the smaller speakers ould certainly not be higher than that f the 12-inch job, and no increase of ound output would be obtained. Speaker ividing networks are complicated and he results with standard speakers are ufficiently open to question to render uch an approach not worthwhile for the imited power output of the receiver in uestion.

**R.W.P. (Wollar, NSW)** wants to know whether we plan to describe a tester or vibrator cartridges.

A.: We have no immediate plans along his line and cannot offer any assistance n the matter. We realise that it would e of interest to country servicemen but he time and effort required to develop and describe such a device would be more than we can spare at the moment.

**J.C.H. (Launceston, Tas.)** says that he has noticed high distortion on many 16mm. sound systems and asks what adjustments can be made to the projectors to limit the distortion.

A.: If you are using a good-quality machine, there should be no need to worry about adjustments, the apertures and optical gear being set up normally by the manufacturer. In fact, it would be most unwise for you to tamper with the sound-optical system in any way. The biggest trouble is with the films themselves and there is a colossal difference between good and bad films run through the same projector. There is nothing you can do about this except pick and choose those to your liking.

**B.G.B. (Launceston, Tas.)** has built the extension speaker unit described in the September issue and is using it with a factory-made receiver he has on hand. He found that the tone control did not work when the extension speaker alone was used, so modified the layout to include the tone control in the grid circuit of the output valve similar to the Simplified Broadcast Superhet. described in the July, 1950, issue.

A.: You have apparently found a satisfactory solution to the problem and other readers with similar receivers will doubtless be interested. We regret that we cannot possibly help in the matter of the circuit of the commercial receiver.

**R.C.C. (Woomera, SA)** forwards his subscription and asks about operating a No. 11 transceiver from 240 volts AC.

A.: Many thanks for the sub. which has been duly recorded. While it would be possible to operate the set with a step-down transformer and rectifier as you suggest, it would hardly be practical in most cases, due to the cost and difficulty of obtaining the required special components. A less wasteful method would be to arrange an AC power supply for the filaments and plates of the valves completely eliminating the genemotors. A metal rectifier and a very elaborate filter network would probably be necessary for the directly-heated filaments in the set. This method, of course, requires a considerable amount of rewiring and it may be better to simply obtain a 12-volt accumulator which could be kept in good condition by a small charger operating from the power mains.

**A.R.M. (Birrong, NSW)** queries the value of the shunt resistor used in connection with the low ohms scale in the "Standard Multimeter." He calculates that the resistor should be 15.15 ohms, while it is shown on the circuit as 14.8 ohms.

A.: The battery used to supply the current for the ohms readings has a definite internal resistance and this is compensated for by slightly reducing the value of the shunt resistance as you have observed. Actually, the internal resistance of the batteries varies throughout their life and it is necessary to choose a compromise value. In any case, ordinary multimeter ohms scales give an indication of the order of resistance rather than a highly accurate reading. The shunt you are using at the moment should be reasonably accurate, especially if you are using a fairly large battery.

## YOUR QUERY?

1. Queries will be answered in rotation through the columns of our magazine if not accompanied by a fee for a postal reply.
2. Queries, neatly and concisely set out, will be answered by mail as quickly as possible if accompanied by 1/- in postal notes or postage stamps. Endorse envelope "Query."
3. Back numbers are rarely available but reprints of most circuits, wiring diagrams, and parts lists will be supplied for 6d each, minimum charge 1/-. Thus a circuit, layout, and parts list will cost 1/6 in stamps or a postal note. Endorse envelope "Circuit."
4. Blueprints of exact size chassis layouts with all essential holes, and cutouts will be supplied if available for 2/6. Endorse envelope "Blueprint."

Address your letters to the Technical Editor, "Radio & Hobbies," Box 2728C GPO, Sydney.

**L.N. (Milford, via Boonah)** makes a request for any reader to correspond with him with a view to interchange of knowledge, practical experience and general information on the matter of radio and photography as hobbies. Although recently becoming interested in these hobbies, he is full of enthusiasm and co-operation.

A. Well, L.N., we have published above the broad details of your letter in respect of your request for correspondence with other hobbyists of radio and photography interests. Your request for data on a portable battery set is rather vague as to general requirement. If you care to drop a further line to the 1/- Query Service in the manner suggested in the panel on this page and with more explicit details of your requirements, we'll see what we can do for you from our circuit and data files.

**C.H.M. (Bororen, Qld.)** asks about the filter requirements for a disposals genemotor he has on hand.

A.: Since the ripple is usually of a relatively high audio frequency, it is usually a fairly simple matter to remove the fundamental component. The choke and electrolytic condensers you already have in circuit should do this effectively. However, in addition to the fundamental, a genemotor creates interference extending high up into the radio frequency spectrum. Normally, this can be removed by a combination of radio frequency chokes and small mica bypass condensers. These components are usually arranged to form a pi network similar to the low frequency filter, but it is essential the bypass return leads be short for which reason they are best connected directly to the genemotor case. The arrangement is essentially similar to that used to filter vibrator power supplies, several examples of which have been detailed in Radio and Hobbies recently.

**P.G.T. (Brighton, Vic.)** wishes to add an RF stage to the "Multie Talkie."

A.: The addition of an RF stage to the set would require complete rearrangement of the filament network. While we would like to help, we very much regret that we cannot possibly spare the time to prepare special diagrams for the benefit of individual readers. However, you may be interested in the "Universal Portable" which was detailed in the January, 1949, issue of Radio and Hobbies. The set uses most of the parts you already have and can be operated either from its own internal batteries or the AC power mains. We can supply the circuits and under-chassis diagram through the query service at a cost of 1/6

**W.B. (Ashgrove, Qld.)** has observed that the voltage measured at the plate of the audio voltage amplifier of his set is lower than that specified by the manufacturers.

A.: What you observe is quite normal and is due to the fact that the meter draws current from the circuit being tested. In most cases the amount of current taken by a sensitive meter is of no consequence but where it is of an order comparable with the total current flowing, a special allowance must be made. For accurate readings under such circumstances a vacuum tube voltmeter is desirable. From the brief description given in your letter we would gather that the distortion on local stations is due to a fault in the AVC system. Check all AVC bypass condensers and also make sure that all associated decoupling resistors are in order.

**P.B. (East Malvern, Vic.)** has a radio using a 41 in the output stage to which he wishes to add a tone control.

A.: It is quite a simple matter to fit a top-cut tone control to a set such as yours. The extra components required are a potentiometer and a paper condenser. Connect one wire from the condenser (.05 mfd. 400V.) to the plate of the output valve and the other condenser lead to either of the outer terminals of the pot. (.05 meg.). The centre terminal of the pot. is returned to the high tension supply. Should the control be sudden in its action, try connecting the condenser to the other outside connection of the pot. We are very glad to note that the "1Q5 One" worked so well.

**G.T. (Orange, NSW)** asks if we can supply him with a wiring diagram for the 1950 Radiogram.

A. Sorry, G.T., but we regret that we cannot help you. We take the view that to successfully complete a set of this type, a constructor would need to have sufficient experience to be able to follow a circuit diagram. As a general rule, we do not prepare wiring diagrams for sets larger than five valve. Apart from this, a wiring diagram for a set like the 1950 Radiogram would take many hours in preparation. The time involved would probably be comparable with that taken to build the prototype set which, as you could well imagine, runs into a considerable number of man hours. For this reason we can never spare the time to prepare wiring diagrams for individual readers, even if only a one or two valve set is involved.

**T.W.V. (Wellington, NZ)** submits for comment the circuit of a 6-valve TRF receiver.

A. We will reserve comment on the circuit until we are able to give it the appropriate space in the columns. Meantime, it has been filed along with other letters in similar strain.

# Readers say:

## Transients

*I consider that Mr. Williams let one of your October correspondents down too lightly. I refer to the reply to a letter signed by Mr. P. Stevens.*

*Mr. Stevens says: "Although one or two watts output is ample for the average home, his creation has to have 12 watts or more."*

*It is quite obvious that the gentleman knows little about the subject. He apparently has never heard of transients, he naturally has never heard them on his 1 to 2 watt outfit. If he attempted to play that excellent recording referred to in "Off the Record"—the Schumann Concerto, which I presume is the Lipatti one, and which starts off with some tremendous chords for the piano, his one watt pet would, in the forte passages, produce something akin, in musical tone, to a couple of sticks being banged together.*

*On the other hand if he brought the same record along to one of those foolish "enthusiasts" with a despised 15 watt Williamson fed by a modern high compliance lightweight pick-up, adequate bass compensation and working into a 15 watt speaker such as a Goodmans mounted in a vented enclosure, even the prejudiced Mr. Stevens would have to admit there was quite a difference. Those heavy piano passages, which on his one watter just blurred and rattled, without any semblance of tone, now come out clean and melodious, no rattle, no blur, just satisfying genuine piano tone, no matter how vigorous the pianist.*

*That, Mr. Stevens, is because, although you apparently don't know it, the sudden burst of energy which arises instantly when a percussion instrument is struck may reach to eight, ten or twelve watts even when the normal operation of the outfit is set to your favorite 2 watts. These transients are of very comfortable aural satisfaction, and call for that reserve of power which is the reason for the 12 to 15 watt amplifier and speaker.*

*Actually, if the 15 watt outfit were taken into a public hall and tuned up to work at its full rating, then it, too, would fall down on rendition of transients because, like Mr. Stevens' one watter, there would be no reserve to handle these essential components. (If 15 watts were needed to fill a large hall adequately, then nothing less than a 50 watt amplifier would properly do the job.) (C. W. Warlow).*

* * *

## Overseas reader

*Howard D. Thompson (Salem, Oregon, USA) writes: "I have a very good friend who lives in Brisbane. He sent me the January and February issues of your very wonderful radio magazine. I do a lot of radio experimenting and have done so for over 25 years and get a lot of enjoyment out of it. I was really thrilled when I saw the article on page 36 of the February issue, telling about the 4-watt amplifier. I was looking for a diagram of a small amplifier to build, and so as soon as I read the article in Radio and Hobbies, I started building it. Now I have it completed and it works wonderfully. I have it hooked up with my tape recorder. I also noticed the simple receiver for 288 Mc. and I have made that up also and it works well.*

*"I read the article on page 48 about Enlarging Your FM Tuner and have made that, too. When anyone comes and sees these sets, I tell them that they were built from plans in a radio magazine from Australia. I like the article 'For the Junior Experimenter.' I read with delight the department, 'A Reader Built It.'*

*"It is very interesting to read through a magazine from some other country and see how they do things. I find that your magazine is published and set up just as well as any of our radio magazines.*

*"I like the article 'Short Wave Notes,' by Ray Simpson. I am very much interested in short-wave listening and have a lot of cards from stations all over the world. I have six verification cards from stations in Australia, and they are only a few of what I hope to get from time to time.*

*"Best of luck."*

* * *

## A bouquet

*Just a few lines in acknowledgement and appreciation of the help Radio and Hobbies has been to me. I have been interested in radio ever since it began to operate, and whenever I have been in need of a circuit to use I have looked up the old Wireless Weekly, and now Radio and Hobbies is my stand-by.*

*The Little General in its various forms has been a success, also the several Advance sets. I also built a couple of amplifiers, the one valve Gramophone was one of them, and also "PA5 High Gain." I used this job for a deaf aid system in a church, connecting a suitable line transformer to it for the phones. It can also be used with the gramophone pick-up as well as for public address and a splendid job it is, too. Wishing you all the best, I am yours respectfully (P. M. Beck).*

# ANSWERS TO CORRESPONDENTS

**Unsigned, of Post Office, Tuena, NSW,** sends in 1/- with a request for a 1-valve receiver using the 1K5-G.

A. We regret that you omitted to sign your name. If you will drop us another line, we shall be glad to forward you the circuit.

**R. Toreaux** (Queensland) writes complaining of the scarcity of SWG wire gauges specified by R. & H. and suggests that B. & S. gauges would be more suitable. He also asks some questions about a R. & H. circuit and submits two of his own for comment.

A. As sure as we specify B. & S. gauges, R.T., we will have a flock of requests to use SWG. Actually the two gauges can be converted quite readily from wire tables, and the resulting discrepancy is then negligible. Many thanks for your report on the "Reader Built It" set, and glad to know you have had such good results. The BFO coil for the double conversion superhet could be an IF transformer of 455 KC, or whatever is the IF used. As mentioned in the handbook, this IF can be anything from 455 KC to 50 KC. The 7 MC crystal would necessitate changes to the coils. Its harmonics would, however, provide a marker point in the amateur bands. The two circuits submitted should function but with much reduced efficiency, and battery drain is likely to be excessive. The tone control circuit is correct. In the case of the TRF set the screen dropping resistor to the first valve could be omitted and we would not recommend the 6SJ7 in this position. The back bias resistor of 1000 ohms is not required in this circuit and the 300 ohm bias resistor in the detector stage is also not required. Care should be taken to see that the current through the phones is not excessive. Some form of shunt feed system may be preferred here.

**M.M. (Hawthorn, Vic.)** advises of his new address and at the same time makes some generous remarks with regard to our magazine.

A. Our subscription department has been notified about the change of address as requested. We are very pleased to hear that your version of the "Jeep" performed so well and trust that you will find as much of interest in future issues of Radio and Hobbies as in the past.

**B.W.B. (Kew, Vic.)** wishes to construct an 80-meter beam from 3-8in diam. rod.

A. The idea is not impossible but most people would find it quite impractical. Each element of the beam would need to be 130 odd feet long so that to support the elements the rotating mechanism would have to be built along the lines of a locomotive turntable. We suggest that you check through the chapters on aerials in the standard amateur handbooks as the subject is much too lengthy to be discussed here. You will probably also be interested in the article on aerials in the 1950 edition of the Australian Shortwave Handbook, which is available from most booksellers at a cost of 2/-.

**J.T. (Beecroft, NSW)** sends in the circuit of a small battery-operated receiver for comment.

A. Although, as far as we can judge from a quick check, your circuit would work, it would be possible to obtain very much better performance by including regeneration in the detector stage. The circuit would then be very similar to that of the "Duplex Single" which, incidentally, we can send to you through the shilling query service. The value you have indicated for the volume control of your set is quite in order and it is not necessary to include a condenser between the microphone transformer and the volume control. The microphone circuit you have indicated should work quite well although we would imagine that the available gain would be much greater than normally required. The tone control circuit also is quite in order. The size of the "A" battery you employ is a matter that can only be decided with a knowledge of the particular circumstances. A single torch cell will give a few hours of life while a large heavy duty "A" battery could be expected to last much longer. Any audio transformer with a ratio between about 1¼ and 3¼ to 1 would be well suited to your circuit.

## Let's Buy an Argument

(Continued from Page 69)

requires a wide-band system, or one with a very short rise-time or one with a minimum of phase delay in the upper register. Essentially the three expressions mean the same thing.

But don't forget that, if the record the pickup, the tuner, the speaker or anything else slows up the vital harmonics, the final sound still has to be rounded off, no matter how good the amplifier is. What's more, if compensation is employed in the amplifier to offset the deficiency in terms of frequency, it will probably compensate matters correctly also in terms of phase. This was part of my original justification for using compensation and tone control of the right kind.

### AESTHETICS

Finally, there has been little time, as I write, for arguments to develop about the aesthetics of reproduction but here are a few random thoughts contributed by Mr. Browne, of Coogee:

*"Individual engineers may set their microphones in quite different positions, even for the same orchestra. Allowing also for monitoring, there would be variations in the finished record equalling an unknown number of db in the amplifier."*

(No comment required.)

*"Nearly all the so-called lightweight pickups have some form of counterbalance. The record, in displaying inevitable eccentricity, &c. must move the total mass of head, the arm and the counterweight."*

(What do you think of this one?)

*"With regard to 78 and long playing records, one method pickup manufacturers are using is to change the stylus. Imagine trying to fit a stylus back into its original position each time."*

(The idea is that the stylus shall not be fitted back into the original position. It is contended that the constant changing will never allow a "flat" to develop on any one face.)

*"The frequency response of an amplifier varies, particularly in the treble, with the setting of the volume control. It would seem that the only way would be to vary the amplification of the audio tubes."*

(There are too many difficulties about this; and gain control using negative feedback is seldom convenient. The problem affects the treble only and the simplest corrective is to bridge the "hot" end of the potentiometer with a selected small value of condenser.)

## STEREO-TELEVISION FOR ATOM LABORATORY

TELEVISION in three dimensions has been developed by engineers at the Argonne National Laboratory near Chicago. Used along with electronic remote-control devices, it enables atomic scientists to conduct experiments at a safe distance from deadly radioactive materials. When operating a mechanical hand three-dimensional views are almost essential in grasping beakers and performing infinite precision tasks behind the lead shields. Dr. H. L. Hull, director of Argonne's remote-control engineering division, has devised two types of stereo-television. Both use the double-lens camera. One receiver presents two nearly identical pictures on the television screen which must be viewed through prismatic glasses to get one three-dimension picture. The other projector superimposes one image on top of the other and looks out of focus until viewed through polarised spectacles.

# WANTED TO BUY, SELL OR EXCHANGE

EXCHANGE OR SELL: New 32-wa Amplifier unit with Garrard PU uni 4v tuner, 3v mixer in case, 12" Rola an cables, for late model car radio. 86 Sutton St., Echuca, Vic.

FOR SALE: Amateur radio ticket Personal correspondence course b radio amateurs. Details Amateur Radi League, Box 1047N, GPO, Brisbane.

FOR SALE: Garrard Automatic Record changers. Model RC65. In brow leatherette carrying case, £16. Leyland 31 Glen St., Milson's Point, Sydney.

FOR SALE: American Webster 3-spee automatic record-changer and pickup complete with adaptor and 240-110 vo transformer. New condition, £50 or offer Apply No. 5468, Radio & Hobbies.

FOR SALE: One each 4 and 5 valve Battery Chassis, complete and wired less valves, 30/-. One each Power Transformer, power valve and rectifier, as new, lot 30/-. Fred Doessel, Proston, Qld.

SALE: AVO AC-DC Test Meter, £7 8m/A m/c Meter, 15/-. 2-1R5, 1N5, 1H5, midget 2-gang, 10/- each. Loop ant. 5/-. Port record case, £1. Arrl. H/book 12/6. Pop. Science Radio Man, 7/6. USA Geographics '46-'49, 2/6 ea. Leitz enlarger, £25. Want pr. good binoculars. Ward 35 Clarke St., West Ryde, NSW.

FOR SALE: 3 valve AC mantel receiver (Minnivox) £7/10/-. B. A. Williams, 103 Bathurst Rd., Orange, N.S.W.

SELL: Set parts to build R&H 5 BP1 C.R.O., with chassis and case, power supply, all tubes and components. All New, assembled, part wired, £20 or offer F. Smith, 32 William St., Forbes, N.S.W.

SELL: 15-watt AC/6VDC Amplifier, 8-valve D/W AC/6VDC Receiver, two 8" Speakers with Transformers, Garrard Motor and PU. All units as new in attractive portable cabinets. Crystal mic, universal test loud speaker. Best offer. 64 Lake View St., Boolaroo.

SELL: ALL R. & H. from May, '44, to Dec., '49. Best offer. S. L. Mann, PO Box 43, Sth. Grafton, NSW.

SELL: Eddystone 640 Receiver, as brand new, £50. E. H. Zahmel, Box 13, Finch Hatton, Qld.

SELL: ICS Course in Radio Engineering, price £33. Will sell for £20. Ring McGill, FA3974, Sydney.

SELL, or exchange for any useful article 85 loose and bound copies of R. & H. from 1939 issue to present, all different, what offers? D. Dennis, Dutton St., Coolangatta, Qld.

SELL: British Jonrad "Globe King" 1 valve short wave receiver with new batteries (two 45 volt, one 3 volt), good earphones (equivalent to Brown's type D) and instructions to operate. Set works perfectly. Bargain £5/5/-. A. Glassey, 24 Geoffrey St., Toowoomba, Qld.

WANTED: Mf SHf dials and dial movements for AR8 receivers. Quote price and condition of dials to J. P. Troy, PB Kerang, Vic.

WANTED: 1946 July R. & Hobbies. Will pay 3/-. Egan, Tolmie, Mansfield, Vic.

**MODELS:** Blue Prints of Old time Sailing Ships. Send 2/- for latest Catalogue. O. B. Bolton, 70 King St., Sydney.

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